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Incorporation of occupational health and safety in cleaner production projects in South Africa

Ph.D. Thesis

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April 2002

Aalborg University
Department of Development and Planning

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List of abbreviations

ABET	Adult Basic Education and Training
ABS	Anti-lock Brake Systems
AESF	American Electroplating Surface Finishers (industry association)
AK-47	Military assault rifle developed by Mr. Kalashnikov
ANC	African National Congress (political party)
APO	Asian Productivity Organization
BCEA	Basic Conditions of Employment Act
CCMA	Commission for Conciliation, Mediation and Arbitration
CFC	Chloro Fluoro Carbon
COFESA	Confederation of Employers of Southern Africa
COSATU	Congress of South African Trade Unions
CP	Cleaner production
CRM	Corporate Risk Management
Danced	Danish Co-operation for Environment and Development
Danida	Danish International Development Assistance
DEAT	Department of Environmental Affairs and Tourism
DI	Disabling Incident'
DIFR	Disabling Incidence Frequency Rate
DKK	Denmark krone (national currency)
DMEA	Department of Mines and Energy Affairs
DOH	Department of Health
DOL	Department of Labour
DTI (a)	Dansk Teknologisk Institut (a Danish consultancy)
DTI (b)	Department of Trade and Industry
EDRF	Environment and Disaster Relief Facility
EMS	Environmental Management System
EOP	End-of-Pipe
EPA	Environmental Protection Agency
EPSF	Environment, Peace, and Stability Facility
ETBPP	Environmental Technology Best Practice Programme (UK)
FAO	Food and Agriculture Organization of the United Nations
FAWU	Food and Allied Workers Union
FIRI	Fishing Industry Research Institute
GDP	Gross Domestic Product
GEAR	Growth, Employment and Redistribution (a South African neo-liberal economic doctrine)
GNI	Gross National Income
GNP	Gross National Product
GTZ	German Technical Co-operation (Deutsche Gesellschaft für Technische Zusammenarbeit)
HACCP	Hazard analysis and critical control points
HCS	Hazardous Chemical Substances
HDGA	Hot Dip Galvanising Association
HDI	Human Development Index

ICPIC	International Cleaner Production Information Clearinghouse
IFP	Inkatha Freedom Party
ILO	International Labour Organisation
IMF	International Monetary Fund
IMSR	International Mine Safety Rating
ISAP	Index to South African Periodicals
ISO	International Organization for Standardisation
LCA	Life Cycle Analysis
LF	Logical Framework
LFA	Logical Framework Approach
LTIFR	Lost-Time Injury Frequency Rate
MBO	Management by Objectives
MBSA	Mercedes Benz South Africa
MOSA	Machinery and Occupational Safety Act
MST	Miljøstyrelsen, the Danish Environmental Protection Agency
Naledi	National Labour & Economic Development Institute
NAO	National Accounting Office (Denmark) (in Danish: Rigsrevisionen)
NBF	National Bargaining Forum
Nedlac	National Economic Development and Labour Council
NGO	Non-Governmental Organisation
NOIU	Navy Inspector General Oversight Inspection Unit (US)
NOK	Norway Krone (national currency)
NORAD	Norwegian Agency for Development Co-operation
NOSA	National Occupational Safety Association
NSCA	National Safety Council of Australia
Numsa	National Union of Metalworkers of South Africa
OHS	Occupational Health And Safety
OHSMS	Occupational Health and Safety Management Systems
OSHA	Occupational Safety and Health Administration
PAC	Public Accounts Committee
PC	Project Cycle
PD	Project Document
PDCA	Plan, Do, Check, Act & Analyse
PIACT	International Program for the improvement of Working Conditions and Environment under the ILO (known as PIACT, after its French name)
PPBS	Planning-Programming-Budgeting-System (US)
PPE	Personal Protective Equipment
PPI	Positive Performance Indicators
R	South Africa Rand (national currency)
SACP	South African Communist Party
SMSE	Small and Medium Sized Enterprises
TOR	Terms of Reference
TQM	Total Quality Management
TURP	Trade Union Research Project
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
USAID	The United States Agency for International Development
WCC	Workmen's Compensation Commissioner
WEA	Working Environment Assessments
WISE	Work Improvement in Small Enterprises
WMC	Waste Minimisation Club

Preface

This book documents the result of a Ph.D. project undertaken partly in South Africa, partly in Denmark. The project was made possible with a grant from the Danish University Consortium for Environment and Development – Industry and Urban Areas (in short: DUCED I&UA) which financed two-thirds of the project, the reminder being financed by Aalborg University, Denmark.

The study has been led by Prof. Per Christensen of Aalborg University. Prof. Per Langaa Jensen of the Denmark's Technical University has supervised the project.

This book is structured in the following manner

Chapter 0, Summary, provides a short overview

Chapter 1, Introduction, describes the what and the why of the project

Chapter 2, Methodology, describes how this is accomplished

Chapter 3, Integration, introduces a simple model for analysing integration

Chapter 4, Planning, introduces two competing theories on planning that informs the analysis of the empirical observations in later chapters

Chapter 5 provides a short introduction to the South African context

Chapte 6 presents the results of two case studies on Danced cleaner production projects

Chapter 7 presents the results of a study on integration in a *large company* setting -- the formal management system

Chapter 8 presents the results of a *small company* intervention method, based on networking and informal exchange of information

Chapter 9 provides a short conclusion

The sequencing of the chapters follows a logical thread, somewhat reflecting the sequencing of the empirical work. The chapters are written in a style that should permit them being read independently of each other. It will, however, be helpful to read the what, why, and how of the project, essentially chapter 1 and to some extent chapter 2 (in particular Figure 3, The four research activities in this study, on page 30), before talking on the next chapters.

Among the great joys of finishing a book is the pleasure of thanking those who made key contributions. The consistent support and moral encouragement of Prof. Per Christensen has been invaluable -- the project would neither have been launched nor completed without his support. I am also extremely grateful to Prof. Chris Buckley and Ms. Susan Barclay from the Pollution Research Group at the University of Natal in Durban, South Africa, who generously gave me access to their Waste Minimisation Club activities. I would also like to thank Mr. Henry Flint from the Compensation Fund in Pretoria who found time in a busy work schedule to extract and aggregate data from that organisation's large data base. Those data were crucial as they permitted an independent check of the results of another larger postal survey. I would also like to thank the auditors and employees of the South African organisation NOSA, who discussed many details of their system with me in an open manner. Finally, I wish to thank the employees and owners of the many companies, large and small, with whom I have spoken.

Copenhagen 2002

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(remove the two Xs, it's an anti-spam measure)

Summary

The purpose of this research is to reveal ways in which occupational health and safety can be integrated in environmental cleaner production projects. Of particular interest are those cleaner production projects that are run by the Danish government's environmental assistance agency, Danced, in South Africa.

The study explores two main avenues of integration. First, integrating through better planning, focussing at the tools and procedures in use by Danced for project management -- integrating occupational health and safety into the project specification, so to speak.

Second, integrating occupational health and safety into the environmental activities that take place at company level. Two ways of doing so are explored, the main distinction being company size. For large companies, integration of *management systems* may be attractive. For small companies, integration into a less formal *network approach* may be pursued. This is integrating occupational health and safety in the project implementation phase, so to speak.

The problem

The first chapter introduces a hypothesis that informs most of this work -- i.e. that environmental interventions may be pursued narrow-mindedly with little or no attention paid to occupational health and safety. The chapter then identifies two potential negative outcomes from this, essentially that it leads to sub-optimal solutions. The first negative outcome is the potential for *media-shifting* -- that the 'resolution' of a problem within the environmental domain creates a new problem in the occupational health and safety domain, leading to a deterioration of workplace conditions. The second negative outcome is the potential for *opportunities foregone* -- that an environmental intervention fails to address occupational health and safety problems that may be unrelated but could have been resolved at little or no additional cost. From a rational point of view, both outcomes are sub-optimal. Furthermore, on ethical grounds, it is morally repulsive if endeavours to improve environmental performance disregard the environment of the workers.

This study finds ample empirical evidence supporting the general hypothesis, that environmental objectives are pursued quite narrow-mindedly. This is also true for Danced's cleaner production projects. They do not specifically address occupational health and safety issues. Workplace conditions are therefore largely ignored.

It is argued that this state of affairs is regrettable -- in itself an opportunity foregone. An analysis of the developments of environmental paradigms identifies cleaner production (*henceforth **CP***) as the most obvious candidate for integration of environmental and occupational health and safety (*henceforth **OHS***) interventions. Cleaner production is the *only* environmental paradigm that is concerned with detailed analysis of the production process. It is the only environmental paradigm that shares this focus with occupational health and safety.

The study has examined in detail an environmental intervention in a small company setting, reported in Chapter 8. This so-called Club study concerns the metal finishing industry. It is comforting to observe that the small companies in the Club study address many so-called twin-problems even if they largely ignore workplace conditions. Twin problems are characterised as those in which problems in the external and the internal environment have the same root cause: the use of a toxic or obnoxious substance in the production process. Addressing this root cause solves both an environmental problem and an occupational health and safety problem at the same time. For instance, if a decision to end cadmium electroplating or a decision to move away from cyanide process technology is taken strictly on environmental grounds, it is also beneficial to workers because those hazardous chemicals are removed from the workplace. However, the chapter agues that there are opportunities foregone.

Integration, a framework

Chapter 3 introduces a model for analysing possibilities for integration. The model identifies three main areas where to identify opportunities for integration. The three areas are tools, actors, and structure integration. Each represents a different understanding of organisational behaviour, which in turn entails different strategies for accomplishing integration. They are summarised in the table below and are used to guide the discussion of integration options.

Table A Summary model for analysing possibilities for integration

Strategy for integration	***Process*** of integration is analysed from an understanding of	***Task*** of integration is explained from the view-point of	***Means*** -- to accomplish integration, do ...
Tool	rational behaviour	decision-making capability	strengthen decision-making capability -- integrate OHS in the intervention methodology used to promote CP
Actor	social systems	interpretation and negotiation of goals and objectives	introduce an actor who can -- identify opportunities, re-interpret goals, negotiate and safeguard OHS interest
Structure	organisational processes	formal lines of authority, hierarchy and power	integrate in reward and punishment structures of project management -- set and communicate goals, employ accountability

The perils of planning

Chapter 6 argues that the dominant project planning tools used by Danced, if applied rigidly, can influence environmental assistance projects negatively. It is argued that a dilemma of *rigour or relevance* exists. If, on the one hand, the rigour of planning is adhered to, we have to sacrifice relevance of project contents. On the other hand, if only relevant project objectives are pursued, we must sacrifice the rigour of planning. The chapter analyses two CP case studies from the perspective of this dilemma. Regarding the first case study, the chapter argues that a reverse process may have determined project objectives. It is plausible that objectives were decided from the availability of measurable and objective indicators of outcomes -- it is not the other way around: that objectives are first determined, then indicators. The indicators chosen enabled objective measurements of an *ex-ante* baseline and of *ex-post* performance, and hence permitted an objective quantification of project impact. The main quality of the indicators appeared to be their quantifiability (*rigour*) -- not their

relevance. The second case study points to similar evidence. The small companies are needy and highly *relevant* to target from an environmental point of view. However, they do not meet the *rigorous* criteria for being eligible for support. In many respects, the large companies have the resources to help themselves and are therefore less needy. They are perhaps also less relevant to target. Yet, they are the ones that are eligible for support.

Chapter 6 specifically argues that inter-agency rivalry between Danced and Danida and a lack of broad political support lead Danced to apply planning tools rigorously. The chapter argues that this would lead to particular problems for integration of OHS issues in such projects because of a general unavailability of quantifiable and objective indicators. Later developments have proven that Danced had a real reason to be concerned over the organisation's survival. Within weeks after the new right-wing government took seat in November 2001, when this study was in its terminal phase, Danced was amalgamated with Danida. Danced personnel were scattered to different Danida units and assimilated there. Danced effectively ceased to exist as an independent organisation with specific policy aims. This summary will therefore not deal in detail with the (now past) special complications arising from the application of the rigour of planning due to rivalry with Danida.

The two case studies in Chapter 6 lead to the following two general conclusions:

- First, that OHS issues must feature in the project specification, the so-called Project Document, that is, integration at the *structure* level. If the Project Document is silent on occupational health and safety issues, this can only be interpreted by the implementing consultant as evidence that OHS is not a legitimate project objective. In turn, this entails that OHS must appear more prominently in the Terms of Reference that start the process of planning a new CP project.

- Second, that it is important to integrate OHS into the methodologies that the implementing consultant uses, when he pursues a CP intervention. This is integration at the *tools* level.

This second type of integration, at the tools level, is then the subject of detailed empirical examinations in the following two chapters. One empirical study concerns interventions in large companies to which formal management systems may be attractive. The other empirical study concerns interventions in small companies. Both empirical studies are independent of Danced CP projects.

Study on large companies

Chapter 7 examines CP interventions aimed at *large companies*. This study is a direct continuation of the first CP case study of Chapter 6 in which environmental management systems played an important role in the implementing consultant's promotion of CP in the fish industry. The basic research question of this chapter is whether a similar approach could be employed within the OHS domain.

The chapter explores two major themes. The first concerns the *effectiveness* of top-down systematic management approaches to OHS prevention -- seeking to answer the question: Do such approaches improve firm's OHS performance?

The second theme concerns the ability to *measure* the quality of *proactive* efforts within the OHS domain. It is argued that traditional measures of OHS are principally inadequate, being reactive in nature and focussing on undesired outcomes. In contrast, proactive indicators focus on upstream indicators of the processes that determine these outcomes. The question is -- Can we find upstream indicators of the processes that determine these outcomes, so-called proactive OHS indicators, that are *auditable* and *certifiable*?

Surprisingly little empirical research has been undertaken to evaluate the effectiveness of systematic management approaches to OHS prevention. Even more surprisingly, what little available empirical evidence there is paints a dismal picture, depicting such systems as a sham. In the year 2000, a report prepared by Australian researchers for the National Occupational Health and Safety Commission on the effectiveness on occupational health and safety management systems stated that "... several experts asserted »*they don't work*« [...]. More common was conditional agreement that they could work, but »*the jury is still out*«". The report continues, "Very little empirical research has been done to evaluate the effectiveness" [1]

Answers to the above questions therefore have relevance beyond this Ph.D. study's immediate research question of how to integrate OHS in Danced's cleaner production projects. Companies increasingly address OHS issues in top-down formal management systems, for instance in ISO series management schemes. In addition, there are ongoing discussions regarding the development of international guidelines on occupational safety and health management systems, for instance the British Standards Institute OHS management schemes (OHSAS 18001), and others. The question regarding effectiveness is crucial to the adoption of such systems. Should it be true that they have no effect within the OHS domain, as some authors have suggested, there would be no reason for companies to embark on them. Should the systems be effective, the question whether companies' proactive efforts

[1] Gallagher et al. 2000:21, 22 emphasis in original, also quoted in Chapter 2, the section starting on page 33

are auditable and certifiable becomes extremely relevant to ISO-type schemes.

Two quantitative surveys were carried out in order to evaluate the effect of a South African OHS management system. The results of this empirical work refute the negative portrayal of the failure of top-down formal management systems within the OHS domain. The two surveys find consistent empirical evidence that companies that have implemented top-down formal OHS management systems have a reduced incidence of injurious accidents. The chapter concludes that integration at the level of methodology is a viable approach.

The answer to the second question, whether such systems are auditable and certifiable, is more complex. The answer to the first part of the question is affirmative: Overall, empirical evidence support that proactive safety performance indicators can be devised, which show improvement in processes rather than outcomes. The answer to the second part of the question is cautiously affirmative. It is plausible that such proactive indicators are certifiable although they seem less able to handle only partial disclosure of information or wilful deception on the part of the audited entity.

Study on small companies

The next Chapter 8 repeats this exercise but this time in a setting of small companies. Top-down systematic formal management approaches to OHS prevention have little or no appeal to owner-managers of small companies. A considerable body of literature suggests that owner-managers of small companies generally view authorities and consultants with mistrust; that they perceive systematic methods to be overly complex; and that written material is often not read and generally has little impact. Interventions in this segment of companies are therefore generally considered to be complex and difficult.

Yet, the ability to effectively target this segment is becoming increasingly important. The last 10-20 years have seen a substantial increase in the proportion of small and medium-sized enterprises. Their proportion of total employment in industry is growing and evidence suggests that their environmental and OHS performance is substandard to that of large companies. Small firms often lack the resources, sophistication and motivation to attain minimum legal standards. Small firms generally experience much higher accident rates than large enterprises. At the same time, they are difficult to target for regulators.

Chapter 8 first describes a cleaner production intervention in the metal finishing industry of Durban, South Africa, an industrial sector in which small companies prevail. The intervention was of an experimental nature, set up to examine if a networking approach developed in Europe in the 1990s could be successfully transferred to

the South African setting. The intervention concept is that a limited number of companies form a Club in which they share information and experiences regarding preventive approaches to pollution.

The chapter then identifies and describes an earlier OHS intervention concept, developed in the 1980s under the auspices of the International Labour Organisation. The main argument of the chapter is that the two concepts share so many similarities that the conditions are met for a successful integration of environmental and OHS issues. It is also argued, however, that the two concepts share the same vulnerabilities. Specifically, it is argued that favourable financial cost-benefit arguments are too simplistic drivers. They ignore both scarcity of managerial attention and opportunity costs, and are therefore, although important, inadequate to predict and explain company behaviour. The intervention becomes far more effective if supported on a broader front, notably if backed by regulatory action.

Raising intervention effectiveness through 'wielding a stick', involving more regulation or higher financial charges, is probably unrealistic, however. Many of South Africa's contemporary problems regarding poverty and crime are perceived as inseparable from high unemployment rates. Job creation is a major priority to the Government and small and medium sized enterprises are seen as the most realistic, perhaps the only, providers of new jobs. Regulatory action or financial charges that would conflict with the objective of encouraging growth of the small business sector are therefore unlikely to be implemented. This leaves the carrot (subsidies) as the most realistic option to improve implementation efficiency.

In summary, the chapter argues that integration at the level of methodology is a viable approach.

Conclusions

In summary, the key conclusions on how to integrate occupational health and safety in cleaner production projects are:

1. It is a necessary precondition that OHS be established as a legitimate project objective. OHS must feature in the project specification, specifically in the so-called Terms of Reference and in the Project Document.

2. OHS issues should be integrated at the level of methodology in the implementation phase. The methodology used by the consultant to promote CP in industry should be modified also to accommodate OHS issues. Research undertaken in this study provides consistent empirical evidence in support of the viability of this approach -- both for large companies for which a formal management system approach may be attractive, and for small companies for which an informal network intervention approach may be more attractive.

3. Positive incentive structures should be established that reward companies which address twin problems. As noted earlier, twin problems are those where problems in the external and the internal environment have the same root cause. The most efficient manner of focusing on twin problems is to target the physical investment subsidy element, simply giving preference to investment proposals that improve both OHS and environmental performance.

4. It is likely to be quite effective to enlarge the actor system and introduce an actor that can safeguard OHS interest while the project is being planned and implemented and who can seize on unexpected opportunities for integration as they arise. This approach should be considered in the planning phase. However, in the protracted implementation phase, the costs of such an actor will likely be prohibitive. While effective, enlarging the actor system is unlikely to be an efficient means of integration.

Chapter 1. Introduction

Background

Danced projects

The Danish Co-operation for Environment and Development (Danced) is a state run aid agency, which specialises in environmental assistance projects[2]. The agency was born out of the recommendations of the 1992 UN conference on Environment and Development in Rio de Janeiro, Brazil. The Rio declaration outlined, among others, that environmental assistance must form an integral part of development policy and that all countries should have shared, but diverse, responsibility for solving global environmental and developmental problems.

Danced began to co-operate with the South African government in 1995. Its project portfolio by mid 2000 is quite broad. Support is given to environmental NGOs (non-governmental organisations), to capacity building in local environmental administrations, to strengthening of the general awareness and public participation in environmental matters, and to white-book studies and the development of national environmental policies in the central administration.

Danced also supports projects aimed at the private industrial sector. The most prominent of these industrial sector projects is the initiative to promote the use of cleaner production technologies in the South African industrial sectors of fish, textile, and metal-finishing.

These projects are the objects of interest for this Ph.D. research study. The purpose of the research is to reveal ways in which an integrated approach to cleaner production can be pursued. An approach that deals both the external environment and the working conditions -- the environment of the workers.

[2] In December 2001, Danced was amalgamated with the state run development agency, Danida, due to a new government coming into power -- well after the majority of this thesis had been written. Danced was formally closed down by late December 2001 and environmental assistance projects will from that date be within the purview of Danida.

Cleaner production

The principal focus of cleaner production (CP) is the anticipation and *prevention of pollution* and waste generation *at the source* coupled with an overall strive to use resources (raw materials) more efficiently. The concept emerged in the 1980s where it represented a radical departure from earlier environmental approaches, most notably because cost-efficiency became a major driver. Cleaner production initiatives were in many instances marketed to companies under the slogan that *pollution prevention pays*.

Private consulting companies embraced CP as a new *production concept*, which could be marketed to companies together with other efficiency oriented manufacturing concepts of Japanese origin, popular at the time, such as the just-in-time reduction of inventories, the strive for quality and zero defects etc.

Regulators also embraced the concept as a new *regulatory strategy*, which held promises of easing the traditional adversarial nature of the relations between environmental authorities and companies. The interests of regulator suddenly were coincident with the interests of industry. The regulators had interests in improved environmental performance of firms. Companies had interests in more cost-efficient production methods. A number of national as well as international bodies (for instance UNIDO) therefore launched initiatives to encourage the adoption of cleaner production techniques in industry.

Danish experiences with cleaner production

In Denmark, the first initiative towards the promotion of CP in the Danish industry came with the government's development programme for cleaner technology, presented to parliament in 1986. The Council for Reuse and Less Polluting Technologies was formed in 1987, which, backed by public funding, offered financial support to the development of cleaner technologies. The council could for instance provide financial support to promising new CP pilot project with the aim to underwrite some of the business risk inherent to all development of new production processes. The policy purpose was to establish and demonstrate in practice the potential of cleaner technologies to improve the environmental performance of companies.

Three such support programmes were carried out in Denmark over a period of 10 years, one programme in the period 1987-1989, one in 1990-1992, and one in 1993-1997. The total budget for these CP programmes is estimated at approximately DKK 620m (83m)[3].

[3] Program details from Andersen and Jørgensen (1995:15-16), financial details from Jensen et al. (1998:2)

The CP support programme in South Africa

The aim of the Danced CP support programme in South Africa is to share the knowledge and experience that has been developed in Denmark as a consequence of this national 10 year effort in the promotion on CP techniques. There is, however, a clear scope difference between the activities in Denmark and the Danced support programme. A considerable amount of effort in the Danish programme has gone into the development of new technologies that, while promising, also represented uncertainty in terms of actual performance, costs, and benefits. The national support programme thus had elements of applied research and development. In contrast hereto, the intent of the Danced support programme is to transfer practical knowledge and experiences, not to undertake development efforts.

The problem -- CP is too narrowly focused

The United Nations Environment Programme (UNEP) defines cleaner production as "the continuous application of an integrated, preventive strategy applied to processes, products and services in pursuit of economic, social, health, safety and environmental benefits." (UNEP 2001). This brief yet concise definition *does* include workplace health and safety which, in principle, is put on the same footing as "environmental benefit".

In practice however, this is seldom so. A review of cleaner production reports, case studies, conference proceedings, articles in journals, and other CP material will quickly reveal that only passing reference is made to worker health and safety issues, if at all mentioned. This fact is also evident in the naming of other environmental concepts such as pollution prevention, waste minimisation, eco-efficiency, green productivity, etc., for which cleaner production is often used as an umbrella term. The naming of these concepts associates more with environmental issues, 'pollution', 'waste', and 'green' than with workplace conditions. Interestingly, advocates of the environmental cause have been able to monopolise the word 'environment' in the public and academic debate in a sense that it excludes the environment of the workers.[4]

Why integrate? -- the sub-optimality argument

Two types of sub-optimalities

Various authors have raised concerns that cleaner production, as currently practised, poses a risk of media shifting from environmental problems to worker (and sometimes community) health and safety problems. The argument is basically one of the existence of undesirable sub-optimalities.

[4] I am paraphrasing Goldschmidt (1995:29) in making this point

Two distinct types of sub-optimalities can be identified.

1 *Media shifting* occurs if problems, when 'solved' within the environmental domain, give rise to new, and unforeseen, problems within the workplace domain.

2 A *missed opportunity* occurs if a cleaner production practice, while improving environmental performance, is only sub-optimal, because a better practice could have been chosen, which also improved workplace conditions.

It follows, that some sort co-ordination or planning activity that could eliminate or at least reduce the probability of occurrence of this type of undesirable media shifting would be beneficial.

Evidence of media shifting in Denmark

There is some empirical evidence supporting that the risks of media shifting are not entirely hypothetical. Handberg (1993:23) provides two examples where projects to reduce environmental pollution resulted in serious and unforeseen occupational health and safety problems.

The first example involved a waste sorting and re-cycle facility in which some manual sorting of waste took place. Unfortunately, toxins created from microbiological activity in the waste caused a number of adverse effects on workers, ranging from acute poisonings to the development of chronic asthma. The problems were so severe that the factory inspector closed down the facility on several occasions.

It is debatable whether this particular environmental project falls under the concept of cleaner production. The environmental intervention does not take place *at the source*, preventing waste from being generated in the first place. Yet, it confirms the general suspicion that environmental projects may be undertaken with little attention paid to workplace health and safety.

The second example by Handberg involved "an ambitious" cleaner production project which was backed by funding from Miljøstyrelsen, the Danish Environmental Protection Agency. The project comprised recycling of process water at Grenå Pap, a Danish paper pulp producer. The project was subsequently awarded the prestigious European Union Environmental Prize. However, microbiological activity was again not sworn in and a number of employees developed symptoms of ill health, which were eventually traced to toxins in the process water.

Embarrassingly, the environmental prize winning recycling system had to be re-designed because the workers fell ill.

The CP clearinghouse study

Nicholas A. Ashford, a researcher at the Massachusetts Institute of Technology, USA, has reported the results of a study conducted for the European Union. The study examined the nature of the information that is available in the International Cleaner Production Information Clearinghouse (ICPIC). This is a knowledge bank under the United Nations Environmental Programme (UNEP) set up to facilitate the dissemination of promising cleaner production techniques. In the study, a representative selection of cases in the ICPIC system were examined.

Ashford (1997:117-118) observes that the "most striking feature" of the case studies was the "complete lack" of information regarding interactions of humans with the production processes, materials, or products. From a worker health perspective, Ashford observes, this is a serious problem that must be solved if media shifting is to be avoided. In addition, information was lacking about the manner in which materials were added to a process, maintained, stored and disposed. Moreover, information on the physical forms of the substances at certain stages in the process was limited. Potential occupational exposure to hazardous chemicals could thus not be predicted because basic information was omitted. This state of affairs obviously hampers an assessment of the possible occupational risks of the new cleaner production techniques in the ICPIC clearinghouse.

The study then carried on with an in-depth analysis of eight technologies that represented a process or product line that had significance from an economic or industrial policy perspective. Four of the technologies worsened the health and safety of workers -- of which two were classified as a "deterioration", and the other two as a "significant deterioration" (*media shifting*). Of the remaining four technologies, three did not trade off environmental benefits for worsened health and safety but were sub-optimal, because *missed opportunities* for even better environmental and worker protection performance were identified by the study participants. The last case was an example of a technology, which both deteriorated worker health and safety and represented a missed opportunity. Indeed, a dismal performance from the point of view of occupational health and safety .

Is lack of integration a material issue?

The study reported by Ashford is unclear on how prevalent this state of affairs is. But the study clearly demonstrates that a narrow focus on environmental concerns can overlook problems created or missed with regard to occupational health and safety.

This revelation can be put in a broader economic perspective. There is consistent evidence that the societal costs from work-related injuries and ill-health are very considerable, although also that their size escape a precise computation.

In the United States, workplace injury costs have been estimated at $140bn, some 2.4 percent of that country's gross domestic product[5]. Lanoie and Tavenas (1996:181) observe that in a typical year in the US, more than 50 times as many working days are lost to work injuries as to labour strikes. Additionally, they observe that from one-half to one-third as many working days are lost to work injuries as to unemployment.

In Australia, the 'total costs' of workplace injuries are estimated at about five percent of that country's gross domestic product[6]. Estimates in Denmark indicate that the 'direct costs' from poor working conditions amount to about 2.5 percent of the gross national product[7], very close to the figure of the United States. Direct costs in the Danish estimate comprise hospitalisation, pensions, and earnings foregone while disabled from work. The cost estimates inevitably depend on the accounting principles in use. Whatever the exact costs are, however, it is clear that we are dealing with very large figures, both in absolute terms, and in proportion to the total wealth produced in the society. Nor should it be overlooked that these cool financial figures represent a considerable amount of human suffering.

In summary, the line of reasoning so far has lead to the recognition of the following points of views:

- That environmental issues easily can be, and often are, pursued narrow-mindedly with little attention paid to workplace conditions.

- That this may lead to the implementation of sub-optimal solutions, either because environmental benefits are traded for a deterioration in workplace health and safety (*media-shifting*) or because less than optimal solution are being implemented (*opportunities foregone*).

- That adverse occupational health and safety conditions lead to very substantial costs to the society.

These three arguments form the both the starting point and the main justification for this Ph.D. study.

[5] Estimate provided in Miller and Galbraith (1995:746) to $140bn (1990 dollars). Word Bank statistics report that the US GDP was $5,750.8bn in 1990 (United States at a glance - World Bank 2001)

[6] Figures from Industry Commission (1995), Canberra, Australia, as quoted in Hopkins (1999:144)

[7] Cost figure referred to in report issued by the Danish National Audit Office (Rigsrevisionen) (NAO 2000:clause 67) amounts to DKK 23bn, a figure that was estimated in 1994. Percentage computed from the Danish GNP for 1993, DKK 900bn as provided by Danmarks Statistik.

Cleaner production -- a paradigm based on prevention

Defining and understanding CP

The definition of cleaner production used in this thesis will be the most recent by the United Nations Environment Programme, which defines cleaner production as

> "The continuous application of an integrated, preventive strategy applied to processes, products and services in pursuit of economic, social, health, safety and environmental benefits."[8]

It is probably more illuminating to review the road that took us to cleaner production than going into the intricacies of the written definition. Over the past half century[9], the industrialised nations have responded to pollution and environmental degradation in (at least) four characteristic ways.

- First, by ignoring the problem.
- Second, by diluting or dispersing the pollution, so that its effects are less harmful or apparent.
- Third, by trying to control the pollution, utilising filters or cleansing processes.
- Fourth, by employing cleaner production through the prevention of pollution at the source of production.

The sequence has thus been one of: ignore, dilute, control, and prevent.

The key difference between *pollution control* and cleaner production is one of timing. Pollution control is an after-the-event, react-and-treat approach. In contrast, cleaner production is a forward-looking anticipate-and-prevent philosophy. Prevention, as is well known, is always better than cure.

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[8] As defined in UNEP's "International declaration on cleaner production" (UNEP 2001). This definition differs slightly from earlier UNEP definitions. For instance, the one in use in the late 1990s, which reads: "The continuos application of an integrated preventive environmental strategy applied to processes, products and services to increase eco-efficiency and reduce risk to humans and the environment". Still earlier, in a 1994 UNEP publication, the concept was defined as: "The continuous use of industrial processes and products to prevent the pollution of air, water and land, reduce wastes at source, and minimise risks to the human population and the environment". I conclude that the object of interest gradually has been broadened from the production process to also the product, the scope of actions expanded from equipment and technology to also services, and workplace health and safety have been more explicitly phrased.

[9] Much of this and the following three paragraphs are paraphrasing text in UNEP (1994:3-4)

Cleaner production can be achieved in a number of different ways, of which three important are: changing attitudes, applying know-how, and improving technology. Technology can be improved in several ways, for instance:

- Change the process or manufacturing technology
- Change input materials
- Change the final product, and
- Reuse or recycle materials on-site, preferably within the production process. (Off-site recycling is not part of cleaner production, though it may bring substantial environmental benefits)

Waste minimisation techniques, for example, emerged as an early form of CP. As documented in a United Nations publication (UNEP 1991), this approach calls for a listing of the production sub-processes, keeping account of the material streams that enter and leave each sub-process. A mass balance is established for each sub-process in which the material streams going into the sub-process (raw materials, utility materials, etc) are balanced with the material streams that leave it (products, waste, etc).

The core idea is that generation of waste represents an inefficient usage of the raw materials. The ideal production process will convert all raw materials to valuable products. Pollution is, in this view, valuable raw material that simply failed to be converted to valuable product due to inefficient practices or production methods.

While the core idea is simple, perhaps bordering to trivial, the techniques are able to produce dramatic results, for instance order-of-magnitude reductions in water consumption. There are also important trickle-down effects. If water consumption is reduced, so is the wastewater volume, which allows a smaller wastewater treatment unit that, in turn, demands less capital outlay.

It is probably difficult to overestimate the significance of this new perception of pollution. When pollution was suddenly viewed as a production inefficiency, pollution prevention became synonymous with more efficient operations, and investments in pollution prevention practices would suddenly show positive pay-back periods. This is in stark contrast with pollution control. Payback periods and other indicators of financial feasibility are invariably unfavourable to investments in pollution abatement.

Related CP terms

Pollution Prevention. The terms pollution prevention and cleaner production are often used interchangeably. The distinction between the two tends to be geographic -- the term pollution prevention tends to be used in North America, while cleaner production is used in other parts of the world. Both cleaner production and pollution prevention (sometimes abbreviated: P2) focus on a strategy of continuously reducing pollution and environmental impact through source reduction

Eco-Efficiency. This term was coined by the World Business Council for Sustainable Development in 1992. However, the concepts of eco-efficiency and cleaner production are almost synonymous. The slight difference between them is that eco-efficiency starts from issues of economic efficiency which have positive environmental benefits, while cleaner production starts from issues of environmental efficiency which have positive economic benefits.

Green Productivity. Green productivity is a term used by the Asian Productivity Organization (APO) to address the challenge of achieving sustainable production. The APO started its green productivity programme in 1994. Just like cleaner production, green productivity is a strategy for enhancing productivity and environmental performance for overall socio-economic development.

Waste Minimisation. The concept of waste minimisation was introduced by the United States Environmental Protection Agency in 1988. In this concept, waste prevention approach and its techniques are defined as on-site source reduction of waste by changes of input raw materials, technology changes, good operating practices and product changes. *Off-site recycling* by direct reuse after reclamation are also considered to be waste minimisation techniques, but have a distinctly lower priority compared to on-site prevention or minimisation of waste. The waste minimisation concept is used in the Pollution Prevention Directive (1992). Currently, waste minimisation and pollution prevention terms are often used interchangeably. Waste minimisation is a broader term that also includes off-site recycling and other means to reduce the amount of waste which must be treated/disposed of. [10]

Cleaner Technology. The terms cleaner production and cleaner technology are used interchangeably in Denmark. Cleaner technology may convey an undertone of a more narrow view of cleaner production, that specifically considers technology solutions to pollution prevention, thereby excluding other types of preventive approaches such as production planning, environmental management, and good housekeeping practices. Because of this slight ambiguity, the term cleaner production should be preferred.

[10] Most of the definitions in this section are based on UNEP 2001a

Evolution of environmental paradigms

The last fifty years or so have seen an accelerated development of environmental paradigms. Describing the development on a rough time line, first-generation approaches to pollution alleviation were mostly concerned with dilution of waste streams. Long wastewater pipelines would discharge effluents far away from shorelines to ensure adequate dilution of the pollutants. Tall smokestacks would release airborne pollutants high above ground to ensure good dispersion and tolerable concentrations at ground level.

However, as it became increasingly clear that the ambient environment had only limited dilution capacity, this approach gradually gave way to new abatement measures based on cleansing or filter technologies. Treatment plants would separate pollutants from wastewater streams, filters would be installed at smokestacks to remove particles and other specific pollutants, incinerators would combust harmful compounds, before releasing the remaining effluent streams into the ambient environment. These second-generation approaches are under one referred to as *End-of-Pipe* (EOP), highlighting the fact that abatement measures are applied at some stage after the pollutants have been created. Filter solutions pay no particular attention to the processes that generate the pollutants but instead to techniques that can take out and concentrate pollutants from the waste streams prior to release.

There are two major drawbacks associated with this second-generation approach. The first is that pollutants are seldom removed, but often merely change medium. Most EOP strategies are thus creating new waste problems, concerning the disposal of the filter products. To make matters worse, in many instances the waste disposal problem is aggravated because most filter solutions consume raw materials -- filter bags, filter aid material, etc. -- increasing the total amount of waste which has to be disposed off. The second major drawback, which filter solutions share with the first-generation dilution approaches, is that pollution abatement is an activity that does not add value to industrial production. Payback periods and other indicators of financial feasibility are invariably unfavourable to investments in pollution abatement.

It is on this background that the concept of CP emerged in the late 1980s as a radically new environmental strategy based on prevention. While the earlier environmental strategies largely viewed the production process as a black box, CP unveils the production process and maintains a clear focus on the processes and sub-processes that generate pollution.

Other environmental paradigms have evolved after CP. It is true for many products that the pollution arising from the production process itself constitutes only a small fraction of the total pollution during the lifetime of the product. The pollution arising from the production or winning of raw materials, the product's usage of various resources (for instance energy) during its lifetime, and the environmental impacts

associated with the disposal of the product, will often outweigh the pollution narrowly associated with the production of it. Life cycle analysis (LCA) has emerged as a fourth generation paradigm to address the complexity of these problems. In response thereto the Environmental Protection Agency in Denmark renamed its 'cleaner production' unit to a 'cleaner products' unit in 1998.

The developments have not stopped here, however. There is increasing interest in the overall environmental performance of *networks* of companies. Companies may in some instances benefit from each other in cases where waste from one company may serve as raw material to another. An interesting example is found in Kalundborg, Denmark, where a refinery, a power plant, and a producer of gypsonite boards exchange streams of waste material and energy. The power plant's waste product from the desulphurisation of flue gasses finds usage as a raw material in the production of gypsum. There is furthermore a complex exchange of streams of energy, where the 'waste energy' of one company is useable in the other. These types of considerations are the core of the fifth generation environmental strategies termed 'industrial ecology' (as in Oldenburg and Geiser 1997) or 'industrial symbiosis'.

An overview of the succession of environmental paradigms is shown in Table 1 overleaf. It is noteworthy that the paradigms do not replace each other. Even if a company has adopted cleaner production practices, there is still likely to be need for various end-of-pipe filter measures as well as a need for dilution of the effluent streams.

This is clearly espoused in the 'hierarchy of environmental management' which places the highest priority on 1) preventing pollution through source reduction, 2) only then on reuse techniques, or closed-loop recycling, and only then on 3) treatment, and finally 4) disposal. That is, in fact, a hierarchy of principles of preventive action[11].

[11] This 'environmental management hierarchy ' is reinforced in e.g. the US Pollution Prevention Act of 1990

Table 1 Succession of environmental paradigms

Environmental paradigm	***Ethos***	***Actions aim to***	***Object of interest***	***Deals with production process***
First generation	dilute and disperse	reduce effects of pollution -- after release	the recipient	issue ignored
Second generation End-of-Pipe (EOP)	cleanse and filter	abate pollution at the point of discharge -- prior to release	the emission	black-box
Third generation Cleaner production	prevention is better than cure	prevent pollution at the source -- when the product is produced	the production process (the firm)	***detailed analysis***
Fourth generation Life cycle analysis (LCA)	cradle to grave	Prevent pollution at the source -- the *product* is the main cause of pollution	the product	some analysis
Fifth generation Industrial symbiosis Industrial ecology	symbiosis and the materials cycle	optimise resource flows within *networks* of firms	material flows in networks of firms	coarse analysis

From this analysis of paradigms, I will argue that the cleaner production approach is the only environmental paradigm that pays detailed attention to the production process. This is an issue of considerable importance to a research project that is concerned with integration of occupational health and safety into cleaner production projects.

Precisely because OHS is intricately connected with the production process, I will argue that the environmental strategy of CP is the one that has the most promising prospect for integration with OHS initiatives.

Preventive strategies within OHS

Dilute, filter, prevent

Similarities can be identified between the environmental strategies described above, and developments within the field of occupational health and safety strategies. Traditional measures to control risks from e.g. exposure to harmful chemical substances have comprised a mix of first and second generation measures. For example measures to ensure adequate ventilation of the workplace (a dilution strategy) and measures to protect the employee from those substances by means of personal protective equipment (a filter strategy).

Strategies involving elements of prevention and combating risks at the source have, however, also played some role for at least a century. The Safety Movement in the USA, which emerged in the early 1900s, campaigned actively for the prevention of accidents through engineering revision. For example by safeguarding the transmission shafts, belt, pulleys and other rotating machinery parts, that were omnipresent at the workplaces of the time and exposed the workers to extreme dangers.

The most important similarity, however, is the prominent position given to prevention as *the* major strategy to improve occupational health and safety.

General principles of prevention

The 1989 European Union Framework Directive (89/391/EEC) on health and safety at work provided a set of "general principles of prevention", which the employer shall apply to protect the safety and health of workers (EU 1989: article 6). The principles are presented below because they so clearly portray a hierarchical and systematic approach to the prevention of adverse workplace conditions.

The principles shall be applied in the following order of priority:

1 avoid risks

2 evaluate the risks which cannot be avoided:

3 combat the risks at source;

4 replace the dangerous by the non-dangerous or the less dangerous (substitute);

5 give collective protective measures priority over individual protective measures

6 give appropriate instructions to the workers.

The emphasis on prevention is unmistakable. Workplace hazards are to be avoided altogether. Only if they cannot be avoided, they are to

be assessed and reduced. First, as close to the source of the hazard as possible. Second, by substituting the dangerous with the less dangerous. Third, only after source reduction and substitution have taken place, should mitigating measures be employed. Collective measures, such as the shielding of a noisy machine, shall have preference over individual measures, such as providing the workers with personal protective equipment. Only then should instructions (behavioural modification) be considered.

Basic preconditions for integration met

I will therefore argue, that important initial preconditions for a successful integration of occupational health and safety into cleaner production projects are met, at least at their face value

- Both subjects pursue prevention as the prime goal (same objective)
- Both subjects direct their analysis at the production process (same object of interest)
- Both subjects employ prevention through established hierarchies of principles (same analytical methodology)

This initial line of reasoning, while quite simplified of course, provides a first optimistic view of the prospects for integrating cleaner production and occupational health and safety. The emphasis of both subjects on the same object of interest, the production process, and on preventive strategies and source reduction, bodes well for the prospects for integration. Of all the environmental paradigms contemplated above, the paradigm of cleaner production is the most obvious candidate for integration with occupational health and safety.

Chapter 2.
Empirical field and research methodology

The empirical field

The title of this project is integration of occupational health and safety in cleaner production projects. Hence, the basic empirical field of this study is 'a cleaner production project' sponsored by Danced and implemented in South Africa.

The term 'project' could perhaps, misleadingly, suggest that the empirical field is narrow, confined to a single project, or to a single set of activities undertaken in a company. This is not so. I will lay out a description of the empirical field over the next couple of pages based on a discussion of actors, activities, the process, and the concept of a standard CP project. Reference will continuously be made to Figure 1 on page 17.

Major actors

While Danced is accountable to the Danish parliament for public funds spent on cleaner production projects, it is important to realise that the Danced organisation itself, in terms of total number of man-hours spent over the project's life, only undertakes a small amount of the actual work. Rather, Danced assumes a project management and co-ordinator role and relies extensively on subcontracting arrangements in which consultants and other actors carry out work on behalf of Danced. These actors are deeply involved in decisions that range from strategy formation and project planning to the more operational day-to-day decision-making activities. They are typically from a consulting company, sometimes a non-governmental organisation, or occasionally, an academic institution. These consultants have considerable influence over the projects and are actors of major importance to this study.

The purpose of the cleaner production project is to bring about some sort of change at company level. The companies that participate in the project are thus major actors (see Figure 1). It is true that they make up a highly heterogeneous group. This thesis will make a crude distinction between two groups of companies, the large and the small. While this operational distinction usually refers to the number of

employees in the company, usually drawing the line at about 100-200 employees[12], this is slightly misleading. The management *structure* of the firm would be a better criterion.

Large companies are characterised by a professional management structure. The term 'professional' is not normative, suggesting that they should have superior intellectual capabilities or aptitudes. Rather it refers to a situation where individuals in managerial positions have entered into an agent-principal arrangement with the equity holders of the company to run the company on their behalf. Management structures in these companies tend to be hierarchic and bureaucratic with well-defined areas of responsibility compartmentalised into a number of staff functions. There is a general manager, a sales manager, a production manager, perhaps a quality manager, a safety officer, etc. Organisational stability and predictability are prized values and systematic 'methods' or rational 'management systems' that bring order to a disorganised world can be attractive to this group of companies.

This is in contrast with small companies in which one individual, usually the owner, handles the majority of the day-to-day issues of the business. He deals with negotiations with new customers, the daily production planning, the occasional hiring and firing of workers, handling the contact with authorities, etc. Lack of time on the part of this individual and the large amount of very different issues that constantly compete for his attention are the important characteristics of this group of companies.

It is sometimes argued that most owners of small and medium sized enterprises (SMSEs) by very nature are different from those of large companies. Many owners of SMSEs have previously been employed and acquired skills in larger companies, the argument goes. But they chose to set up their own company precisely because they wanted to have more direct control and greater flexibility to adjust quickly to business opportunities. Systematic 'methods' and 'planning tools' that intend to bring order to chaos may therefore be perceived as simply being incompatible with the core values of small companies. Perceived disadvantages of such methods include that they are time consuming, may limit the prized flexibility and perhaps threaten the owner's perception of control. There is a considerable body of literature that suggests that SMSEs generally view consultants with mistrust, and that they perceive systematic methods to be overly complex. Written material, for instance, is often not read and has generally little impact on this group of companies[13].

The last actor depicted on Figure 1 is the National Accounting Office (NAO) which oversees that public funds are spent efficiently by Danced and in accordance with the guidelines laid out by parliament.

[12] For instance as defined in South African legislation (Act 102, 1996,:schedule)
[13] Sacob (2000). Tait and Walker (2000). Limborg and Hasle (1996).

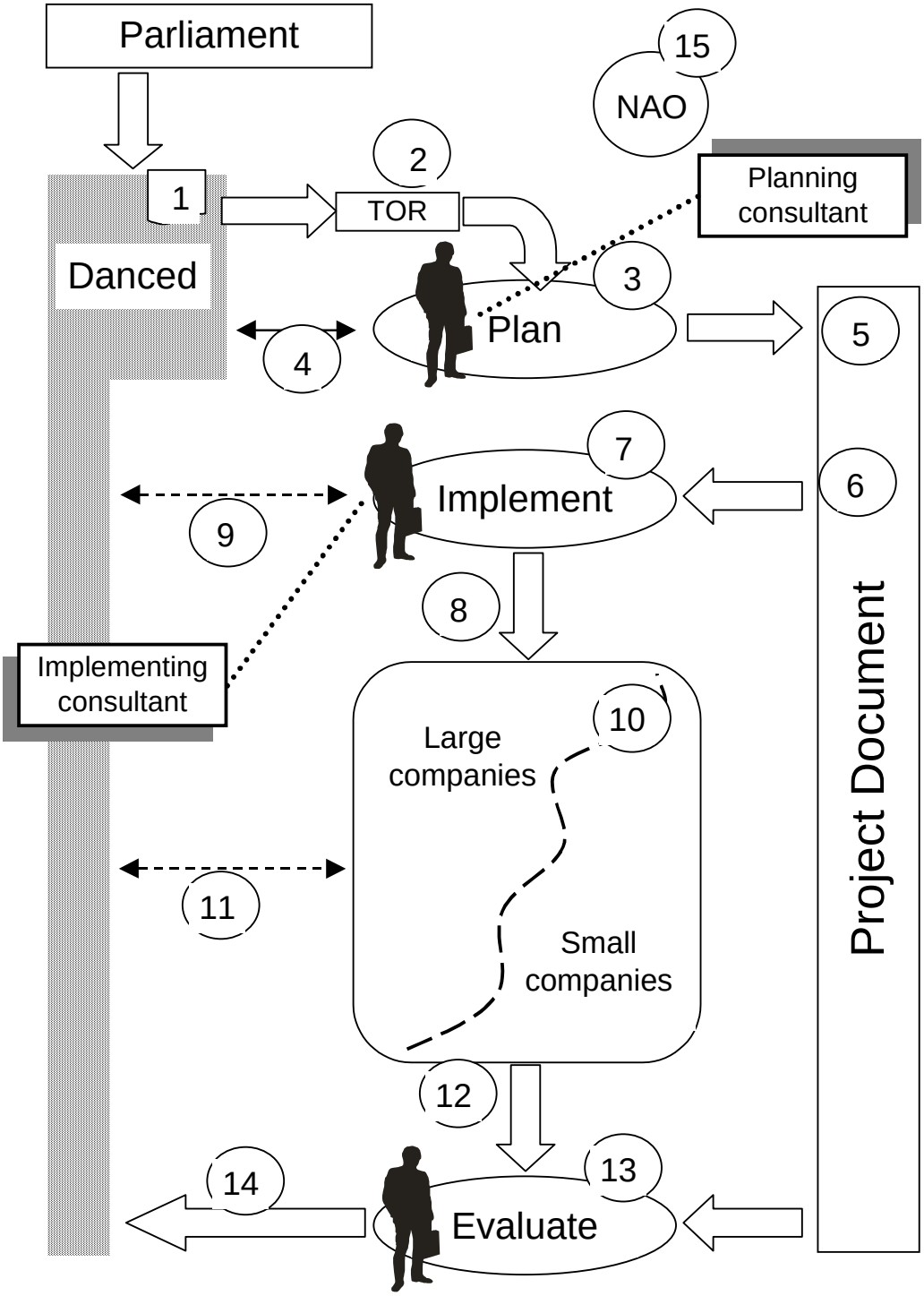

Figure 1 Outline of a Danced cleaner production project -- the empirical field of this study

Activities

Three major activities can be identified in a cleaner production project: planning, implementing and completion. The activities are conceptually straightforward. The purpose of the planning activity is to identify and focus the project on a set of problems, which within the constraints in terms of funding, time and available knowledge and in combination with opportunities and other external factor are likely to yield the best attainable project results. Implementation is also conceptually straightforward, simply to implement the planned activities. In the completion phase a review is carried out where results actually achieved are compared against the planned expected outcomes of the project and lessons learnt recorded.

The process

The description that follows below is very simplified and only serves to provide an overview of the process. Reference is again made to Figure 1, numbers in parentheses corresponds with the numbers on the figure.

The process starts with the Danish government in parliament giving Danced a mandate to carry out environmental assistance projects. Based on this mandate, Danced produces a number of overall strategy papers, including a South African country programme (1) that defines the areas of priority. Within the bounds of this strategy projects may be defined and supported financially by Danced.

At some stage in time, a decision is made to support a cleaner production programme in the South African industry. This begins the project preparation (PLAN) phase. Danced then *subcontracts* the actual task of project planning to a consultant based on (2) a contractual agreement, a so-called Terms of Reference (TOR). Subcontracting is a commercial business activity and the consultant is selected after a competitive tender procedure has concluded.

The selected consultant (3), henceforth: the ***planning consultant***, then starts the planning task in accordance with the guidelines laid out in Danced's two major planning tools for programming new projects: the so-called Logical Framework Approach (LFA) and the Project Cycle (PC). These two tools prescribe at length which good-planning-practices and procedures that are to be followed. The LFA tool, for example, defines a two-phase, seven-step approach to be used during the project preparation phase. As the planning task is advancing, progress meetings (4) are held with Danced. The final outcome (5) of the project preparation task is a *Project Document*.

In principle, this central and highly structured document constitutes an all-inclusive specification of the project. It includes detailed descriptions of the objectives and results that the project shall attain, the activities necessary to achieve those objectives, and the corresponding inputs, e.g. financial inputs, required.

The project now moves into the implementation (IMPLEMENT) phase. With the Project Document serving as the Terms of Reference (6), laying out the details of the contractual agreement, a consultant (7), henceforth: the ***implementing consultant***, is selected for implementation of the project. The selection is again preceded by a competitive tender procedure.

Over the next three years the implementing consultant undertakes the day-to-day management and major decision-makings (8) of the project, guided by the intentions and objectives set out in the Project Document. There is a formal fixed-interval reporting procedure (9) in which Danced may monitor and review project progress. The industry association of the companies that participate (10) in the project have representatives on a Project Steering Committee, in which also Danced has a seat, which gathers at fixed intervals providing Danced with a further opportunity to monitor (11) project progress.

As the project ends some results (12) have materialised. In the completion phase that follows (EVALUATE) a new consultant (13) will be appointed to review the quality, quantity and sustainability of those results and compare them with those that were anticipated in the Project Document. Lessons learned, positive and negative, are to be fed back (14) into the Danced organisation to enhance the planning of future projects. At any time may the National Accounting Office (NAO) carry out its own evaluative investigations (15) and channel this information back to parliament.

Fragmentation, potential for disorganisation and a profound reliance on written documentation

The course of events described here cannot do justice to the complexity of the planning and project management tools that are in use and Danced's project management procedures. For instance, the Project Cycle (PC) planning tool identifies twelve distinct phases in a project, starting with project identification, and ending with impact evaluation. Other consultants than those mentioned above may be involved in pre-appraisal, appraisal, monitoring and review activities. There are also other important pieces of written information than the Project Document and the TORs, etc.

Nevertheless, the description above suffices to illustrate three major points. First, that there are multiple principal-agent relationships, that is, contractual arrangements between a principal (Danced) and an agent (a consultant) acting on behalf of the principal. The role of Danced is to co-ordinate and manage the process, not to enter into detailed planning or implementation activities.

Second, that there are manifest forces at work that tend to fragment activities and disorganise the process. There are many interfaces and there is a lack of continuity arising from the use of different consultants. This discontinuity, or segmentation, is a deliberately

sought feature of the project management approach, as it is a mechanism to control any vested interests of the consultants. Experience and common sense tell us that an individual (consultant) who implements a project cannot be expected to evaluate his own efforts in an impartial manner. The same line of reasoning lies behind the use of different consultants in the identification, planning, appraisal, implementation, monitoring and evaluation phases.

Third, that the fragmented approach leads to a heavy reliance on written documentation as the carrier of information and continuity. In fact, the objectives oriented project planning and management tool, LFA, was originally developed in order to enhance the quality of the project documentation. The LFA tool structures the main elements in a project, highlighting the logical linkages between intended inputs, planned activities and expected results. It also organises important assumptions, indicators, and means of verification, which shall assist subsequent evaluation activities[14].

The Project Document -- management by specification

The implication is that the controls are of a bureaucratic and hierarchic nature. Development organisations manage their projects almost exclusively through written specifications. A multitude of actors may undertake the actual work, often in competition with each other based on parameters of price and professional capability, but the project specification, primarily as expressed in the Project Document, is the principal means of control. This specification defines the project in its entity and assures continuity and consistency over the project's life cycle.

In principle, the project document constitutes an all-inclusive specification of the project. It constitutes the contractual basis between the sponsor (Danced) and the implementing consultant. The project document lists a number of objectives that the project must achieve in conjunction with a set of indicators of how to verify if those objectives have been met when the project ends. The project document is therefore also an instrument of control that holds the implementing consultant accountable for his performance on the job.

It is in this context that the Project Document becomes a document of key importance. The Project Document becomes the glue that binds together the web of actors and activities that constitute a project.

The structure and elements of a CP project

By mid 1998, Danced planned to undertake three cleaner production projects in South Africa: one project in each of the three industrial sectors of fisheries, textile, and metal finishing.

[14] The PC and LFA tools are described in more detail in e.g. Mikkelsen (1995). The topic of planning in environmental projects is dealt with in more detail in Chapter 4.

Strategic analysis had preceded the selection of these three industrial sectors. One of the considerations that influenced the choice of sectors was that cleaner production demonstration projects had been undertaken in similar Danish industrial sectors. There was thus a knowledge base in Denmark, not only concerning specific technology solutions at company level, but also concerning managerial technology, including a number of analysis and decision support tools.

Analysis of lessons learnt from earlier CP projects had furthermore revealed the importance of an early involvement of key actors within the sector, specifically the sector's employer association as well as the sector's normal providers of expertise, for instance a sector research institute. Experience had shown that the involvement of these actors greatly facilitated the dissemination of results (within the sector) after project completion, thereby increasing overall project impact. Involvement of these actors was therefore laid out as a precondition if Danced was to provide financial support.

Table 2 Elements of a 'typical' Danced cleaner production project, as it was conceived for the South African fish industry

Project phase	*Main activities*	*Outputs*	*Danced support*
Information	Study tour and training course	Participating companies have a general knowledge of CP opportunities	Financial support to study tour (100 %)
Analysis	CP audits and feasibility studies	Investment proposals	Lump sum subsidy to CP audit (estimated at 25 %)
Physical investments	Carry out the investment projects	New plant hardware in operation	Subsidy to capital outlay (20 %)
Dissemination of results and awareness creation	Information campaign	Other companies are aware of CP opportunities	Subsidy to information dissemination activities

Note: The typical total budget of a Danced cleaner production project is around DKK 12m. About 40 percent of that amount goes into the physical investment subsidy.

Source: Information in the Project Document (Danced 1998)

A typical project would comprise four main activities: information, analysis, implementation and dissemination (Table 2). The first phase would comprise an information campaign to arouse interest amongst potential industrial enterprises and address negative myths, in particular myths concerning the unfavourable financial feasibility of CP pollution abatement. An important activity in this phase was a study tour to other industries, which had successfully implemented CP

measures. The second phase would deal mainly with technical analysis. Interested enterprises would conduct environmental audits in which CP options would be identified and their feasibility evaluated. The output of this phase would be a number of CP investment proposals, which would be forwarded to Danced as part of an application for financial subsidy. Actual investments would then be carried out in the third phase. The fourth phase would comprise dissemination of the positive experiences with CP, in order to promote a more widespread adoption of CP practices in the South African industry.

The underlying assumptions of a Danced cleaner production project are thus that CP options are fundamentally favourable to industry but that a number of barriers are first to be overcome. In particular barriers associated with lack of knowledge, misconceptions about poor financial feasibility, and lack of seed capital. The fundamental project idea is that the successful implementation of a limited number of demonstration projects and subsequent promotion of the benefits of these projects will significantly facilitate the promotion of CP in South African industry.

The description so far has concerned the empirical field of this study, in particular outlining the concept of a Danced 'cleaner production project'. The description will now move on to a discussion of the research strategies that have been chosen to examine this empirical field.

Four research types

Launsø and Rieper (1997:39) provide a typology involving four distinct research types: the 1) descriptive, 2) explanatory, 3) understanding, and 4) action oriented research types. A typology always involves some reductionism in order to be able to fit a number of complex, and to some extent overlapping, concepts into an orderly framework. It is nevertheless a useful vehicle to describe and add perspective to the research activities undertaken in this study, which draw rather freely from all four main categories. With this caveat in mind, I will proceed with a brief review of the typology.

The descriptive research type

This research type has its historical origins in the production of national statistics. How many people were in injured in workplace accidents last year?, how long was the average recovery period?, the 25 percentile recovery period?, the 50 percentile?, etc. Which type of workplaces produced which injuries?, what is the distribution of accident rates in terms of company size?, in terms of management structure?, in terms of safety committee meeting frequency?, etc. The core question in this type of research is: What is the distribution of x in terms of y? An often-used methodology is the sample survey.

Some central quality requirements must be met for this positivist research type. The phenomena must be described (measured) 'accurately', that is, the measurement must reliable, valid, precise, and generalizable.

Reliability refers basically to repeatability, that the operations of the study, such as data collection procedures, can be *repeated* with the same results by different researchers. This implies that the researcher is neutral and that neither he nor his techniques of measurement influence the subject of the research in any manner.

Validity (sometimes construct validity) means that the correct operational measures are established. Does the researcher really measure what he claims to be measuring? The issue of construct validity in OHS studies is not trivial and laden with difficulties. In the measurement of occupational illness, for instance, construct validity would be compromised if a measurement of occupational sickness, which is related to social role performance, were confused for occupational illness, which is biology based. When researching accident rates, the researcher must be cognisant of the intricacies of the various data sources.

In South Africa, for instance, non-fatal accidents are only reportable to the Department of Labour (DOL) if they result in 14 days or more off work, while they are reported to the Workmen's Compensation Commissioner (WCC) if they result in one day or more off work. But on the other hand does DOL reporting comprise accidents to all workers, while WCC reporting only comprises accidents to insured workers, leaving out uninsured groups of workers. Reporting of accidents may furthermore be influenced by a number of other factors not related to the occurrence of accidents, for instance financial incentives to over- or underreport accident, coercive pressures of overt or more subtle sorts if somebody is embarrassed by the occurrence of an accident, etc. Improper use of data sources may thus easily compromise the validity of the findings.

Precision refers to the unit of measure being employed, for instance if absence from work is measured in hours or in days.

Generalizability, sometimes termed *external validity*, refers to the last stage of the research activity -- if the findings have greater validity than merely for the project in which they were generated, if the findings from a sample are generalizable to a larger population.

The dominating perspective in the descriptive research type is that of the researcher. He identifies the problem to be researched, he defines the data collection instrument, and he controls the data collection procedure. The subject of the research is basically seen as a passive provider of information. The relation between the researcher and the subject of the research is one of distance and minimal interaction in

order not to compromise the quality requirements associated with positivism[15].

The explanatory research type

The major aim of explanatory studies is to indicate causality between variables or events, to attempt to explain a given phenomenon in terms of specific causes. The core questions in this type of research are: which x are causes to y?, or which y are consequences of x?

The general quality requirements are the same as for the descriptive research type. But a valid causal explanation must meet three additional requirements (Mouton and Marais 1990:43):

- That a demonstrable relationship exists between the phenomena or, stated differently, that the causal (or independent) variable x co-varies with the dependent variable y, and

- That there is a specific sequence of cause of effect (temporal sequence)

- That a specific phenomenon, x, is the real cause of y

There is a direct link between explanatory research and predictive and evaluative research. If it were possible to construct a causal and universally valid model of x leading to y, it would, in principle, be possible to make generally valid predictions of future interactions of x onto y.

This research type is in extensive use in the medical community where it is embodied in the so-called controlled experiment, in which study units (patients) are allocated at random to either experimental (treatment) or control (non-treatment) conditions. A characteristic of this approach is that causality is defined in terms of an underlying law of nature.

However, critics of this positivistic tradition have argued that similar laws have yet to be discovered in the social sciences. Causal relationships in the social sciences would imply determinism, the argument goes. But if it is assumed that human activity is free, as implied in voluntarism, causality in the explanation of human behaviour cannot be supported.

Evaluative research is concerned with the assessment or evaluation of a given practice or intervention. For example, if the implementation of a set of systematic safety management activities leads to a reduction in the number of accidents. However, because controlled experiments are very difficult to undertake in a social setting, and because the entire

[15] For a more in depth discussion of positivism see, for instance, Mouton (1993)

concept of causality can be contested on philosophical grounds, evaluative research activities cannot be expected to yield 'solid evidence' in favour of certain propositions in the social sciences (and in much OHS research).

The interpretative research type

Interpretative social research is concerned with the *discovery of meaning* -- of finding out what people think, and how their personal reasons and motivations can be used to understand them. An often-used methodology is the case study in which the researcher attempts to discover meaning through interviews, participant observation and content analysis of written material.

Interpretative research holds that meaning is created in a social system. Meaning is a *social construction* in which the observer cannot escape his own social experiences and tacit knowledge. It is therefore impossible for an observer to ask an 'objective' or value-free question, because a question will always be constructed from the (unique) set of tacit knowledge, that make up the researcher's background. A problem can never exist in isolation, a problem is always a problem to *somebody*, and this is as important to discover, as to discover the problem itself.

Traditional positivist notions of objectivity and quality are discarded in interpretative research. Indeed, most adherents of interpretative research are firmly rooted in a critique of positivism[16]. Instead, they seek to define different sets of quality criteria, for instance methods of triangulation, in which a result is trustworthy, if several different methods lead to the same result. The reader is referred to literature in the footnote for a more detailed discussion of these issues.

The core question in the interpretative research is: What is x? This type of research is therefore often *generating new hypotheses* or new theory. For instance, a case study referred to in Yin (1989:37) was based on experiences from a single city, New York. However, it

[16] Pauw (1993:99) gives a lucid introduction to phenomenology starting with the punchline of a catholic congregation joke: 'Are you confessing or are you bragging?'. In order to tell, we must attempt to understand *from within* this person's mind, we cannot expect to be successful if we seek to explain *from the outside* as a positivist would attempt to do. Also, a very well articulated phenomenological critique of positivism and, at the same time, a balanced recognition of the problems arising from discarding the notion of objectivity, are presented in Silverman (1973) and Walsh (1973). For example, Silverman (1973) quotes Pollner that "All inquiry has a domain which is presumptively *independent* of its being taken up in concern, indeed, without the presumption of an essentially objective world, inquiry loses its sense of inquiry." (ibid:6, emphasis in original). Interpretative research is also closely related to hermeneutics and the hermeneutic circle (e.g. Launsø and Rieper 1997:28). See also Schön's convincing account of how problem setting is a process in which we *name* the things to which we will attend and *frame* the context to which we well attend to them (Schön 1983:44). A review of validity requirements for qualitative case research is provided by Yin (1989:44).

covered broad issues in urban planning, such as the role of sidewalks, the role of neighbourhood parks, the need for small blocks, etc. The study challenged existing theories and eventually led to new empirical inquiries to examine some of the new propositions. Although findings from a case study 'sample' cannot be generalised to a broader population, Yin argues that findings from a case study can be generalised to theory.

The action research type

Action research is, at its name implies, specifically committed to the use of action as a means to bring about social change. Most action research takes its point of departure in a clearly expressed political agenda: one of empowerment, especially of less powerful people, one of social change, one of democracy, and one of bringing about a change in people lives towards the better. Action research embodies elements of learning and change, which are seen as inseparable from the research process itself. The core question of action research is: How do actors develop new patterns of acting (or behaviour) as they acquire new knowledge, either presented to them by the researcher or through a process of self-discovery, as the research activity proceeds?

Action research is a research practice with a clear social agenda. It promotes broad participation in the research process and supports action leading to a more just or satisfying situation for the stakeholder. Its aim is to democratise the relationship between the professional researcher and the local interested parties. Action researchers criticise the interpretative approach for being too subjective and relativist -- the interpretative approach is seen as passive, not helping people to see illusions around them so that they can improve their lives.[17]

Action researchers thus discard standard notions of positivist objectivity. They do so overtly and with pride, claiming that they face a fundamental choice that hinges on a dilemma of *rigour* or *relevance* -- the dilemma of rigour of science or the relevance for usable knowledge. Quoting Argyris and Schön (1991): "If social scientists tilt toward the rigor of normal science that currently dominates departments of social science in American universities, they risk becoming irrelevant to practitioners' demands for usable knowledge. If they tilt toward the relevance of action research, they risk falling short of prevailing disciplinary standards of rigor." (ibid:85).

Action research can produce insights, and in particular bring about *changes* in the existing situation, that the other types of research cannot. However, the continuous blending of intervention, observation, and theory construction in action research creates severe

[17] The core question is paraphrased from Launsø and Rieper (1997:33). The strongly articulated positions in favour of action research are taken from Greewood and Levin (1998:3-4) and Neuman (1994:66-68). For a discussion of the possible validity shortcomings of action research activities I will refer to an illuminating analysis provided by Argyris and Schön (1991).

and largely unresolved problems for evaluating the quality of action research interventions and the validity of their findings. This caveat should be borne in mind but is not dealt with further in this chapter. Readers are referred to the references provided in the footnote.

Four research types brought together

As was noted in the beginning of this chapter a typology always involves elements of reductionism, highlighting core features of the different research types in their pure form, and emphasising the differences amongst them. Yet, this section will conclude precisely with presenting a typology of the four research types (Table 3).

Table 3 Differences among the positivist, phenomenological and post-modern research approaches

	Descriptive and explanatory research (positivism)	***Interpretative research***	***Action research***
Reason for research	To discover natural laws so that people can predict and control events	To understand and describe meaningful action	To smash myths and empower people to change society
Nature of social reality	Stable pre-existing patterns or order that can be discovered	Fluid definitions of a situation created by human interaction	Conflict-filled and governed by hidden underlying structures
Nature of human beings	Self-interested and rational individuals who are shaped by external factors	Social beings who create meaning and who constantly make sense of their worlds	Creative, adaptive people with unrealised potential, trapped by illusion and exploitation
An explanation that is true	Is logically connected to laws and based on facts	Resonates or feels right to those who are being studied	Supplies people with tools needed to change the world
Good evidence	Is based on observations that others can repeat	Is embedded in the context of fluid social interactions	Is informed by a theory that unveils illusions
Place for values	Science is value free and values have no place except when choosing a topic	Values are an integral part of social life: no group's values are wrong, only different	All science must begin with a value position, some positions are right, some are wrong.

Based on Neuman 1994:75

It is true that there are fundamental and severe epistemological differences amongst them, and that differences on this level tend to group the research types into competing, and somewhat mutually exclusive, approaches for research. Indeed, when the research types are grouped by their epistemological underpinnings, as in the typology in Table 3, there appears to be little prospect of bringing the research approaches together in one single research project. They appear as competing, and mutually incompatible, views on how research can be conducted.

However, the research types may also be seen as *complementing* (in contrast to *competing*) each other, bringing together insights that neither technique cannot provide by itself alone. This more benign view of the different opportunities that each of the research traditions offer, is one that is pursued in this thesis.

Mouton and Marais (1990:168) illustrate this point of view in their presentation (after Van Leent) of a 'scientific space' (Figure 2) consisting of three dimensions. In this view, a research project can combine methodologies from both quantitative and qualitative research methodologies, supplementing rather than excluding each other.

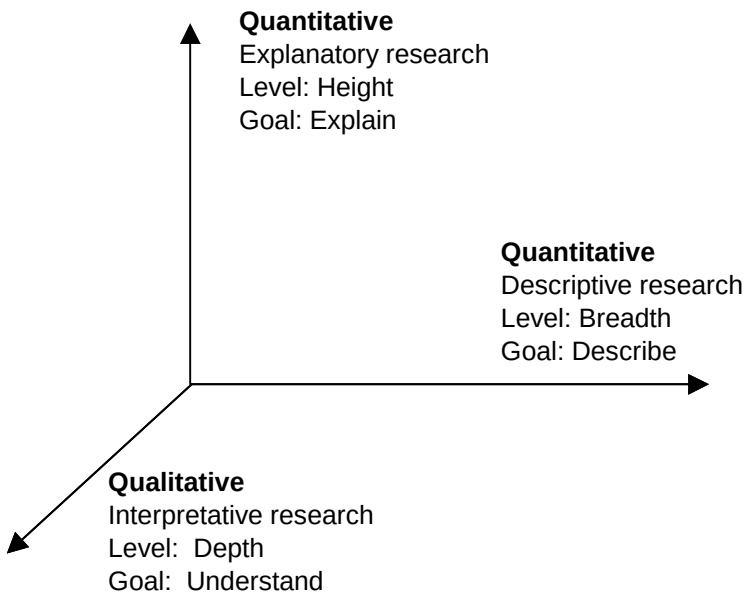

Figure 2 Research within three dimensions of the 'scientific space'

After Mouton and Marais 1990:170

- On the breadth dimension in the 'scientific space', the scientist attempts to describe a phenomenon as exhaustively as possible, for instance using survey research techniques within the descriptive research tradition. Approaches to theory development on this dimension would, for example, include the construction of typologies.

- On the height dimension of the 'scientific space', the researcher concentrates on a detailed investigation of a single variable, attempting to explain phenomena in terms of causal relationships. This activity falls within the explanatory research tradition. Research techniques would include experimental designs seeking to control nuisance variables as stringently as possible. In the field of theory construction the researcher tends to follow a hypothetico-deductive approach.

- The third dimension is characterised by attempts to penetrate the nature of phenomena, seeking to understand how our research subjects construct meaning from their experiences in real life. Questionnaires and other pre-constructed measuring instruments of inquiry are not suitable for this purpose. Instead, we must turn to *qualitative methods*, conducting unstructured interviews, participant observation etc, activities that fall within the interpretative research tradition.

Compared with the typology in Table 3, Mouton and Marais' scientific space does not accommodate action research. A fourth imaginary dimension could be added to the figure representing the extent to which it is the purpose of the research to bring about change. That is, the extent to which research is oriented towards action or merely towards the provision of new insights. Mouton and Marais do not include action research in their figure, probably because that research type was only in its embryonic stage in the mid-1980s. Still, a fourth dimension can be included conceptually, but not visually, of course.

This Ph.D. study has taken the approach of positioning itself rather freely in the expanded 'scientific space' of four dimensions. The basic position is that we must be open to those insights that the different techniques can provide us with, as long as the shortcomings of the various techniques are kept clearly in mind, in particular what concerns the questions of validity and quality. As will be described below, this study employs research activities that draw generously from all four research traditions.

Research activities and methodologies

Activities relate to distinct segments of the empirical field

The research undertaken in this Ph.D. study can be grouped under four separate headlines. This differentiation is based on how the research activity relates to the large and quite complex empirical field, as it was unfolded in the earlier Figure 1. Each of the four research activities thus deal with a defined segment of the empirical field as visualised in Figure 3 below.

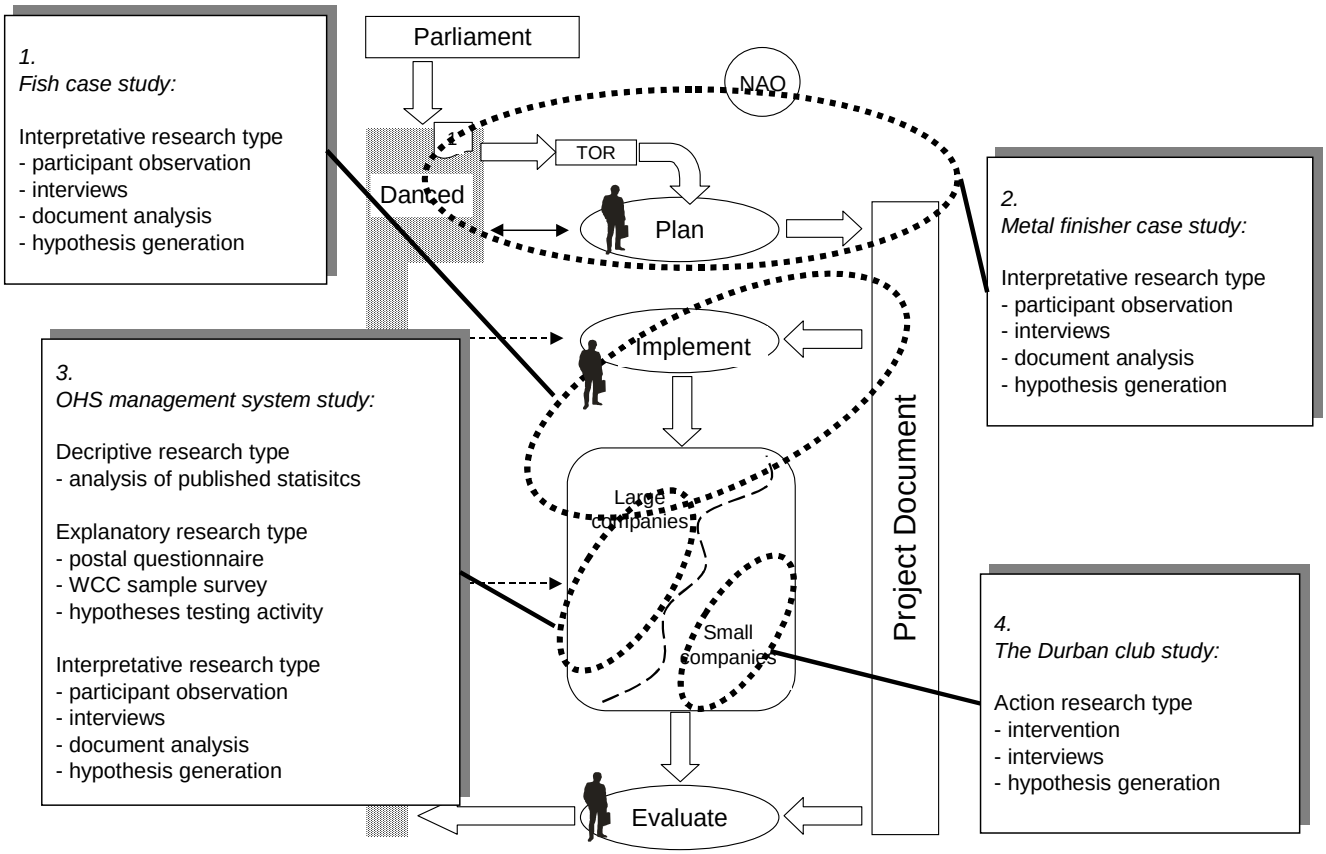

Figure 3 The four research activities in this study

The first two research activities relate to two of the Danced cleaner production projects, the ones for the fish and for the metal finishing industrial sectors. The main difference between them is one of timing, as the two CP projects are in different phases of their project cycle. The fish CP project provided an opportunity to gain insights into what happens in the *implementation* phase, whereas the metal finishing study was an opportunity to examine the initial *planning* phase. This

was more or less in accordance with what was initially planned in the study plan of this Ph.D. project. But, the CP project for the textile sector, which was planned to be the *main* study object, was delayed for about one year, partly due to considerations whether a more product oriented approach should be pursued in this project. Fortuitously, opportunities for two highly relevant research activities emerged, one concerning the application of formal management systems to OHS, the other concerning an intervention in small business setting.

The fish case study (project implementation activity)

The fish cleaner production project should abate pollution from a relatively small number, less than twenty, large companies. By the end of 1998, precisely when this study was initiated, the fish project was about to start its implementations phase. The final Project Document had been prepared, the tendering process had been completed and the implementing lead consultant was appointed shortly thereafter. The timing and setting for the fish CP project was therefore ideal for undertaking a case study of the activities and processes that take place in the initial implementation phase.

The first phase of the CP project, the two-week study tour, took place in April 1999. The study tour comprised two elements; partly visits to Danish industries that had successfully implemented various CP technologies and partly presentations on CP concepts and techniques. I joined this study tour as a participant observer. At the end of the study tour I undertook a survey of the tour participants' expectations prior to the tour, their attitudes towards CP and which activities they would engage in when they returned to their companies in South Africa. The survey took the form of a questionnaire in which the respondent marked their responses on a Likert scale, a few questions were open-ended.

Back in South Africa I visited six of the fish companies and undertook unstructured interview with the participants from the study tours. The fish case study was furthermore based on content analysis of written material, primarily of the Project Document and of the written training materials that were part of the study tour.

These activities in this case study generally fall under the heading of the interpretative research type, where the purpose of the research activities is to discover meaning and generate hypotheses. The general industrial setting of the research activities is one of *large companies*, apparently receptive to 'management system' approaches.

The metal finisher case study (project planning activity)

Metal finishing covers a potentially large number of operations in which a metal product is given some sort of surface treatment. It comprises galvanising, electroplating, painting, coating, and other processes. Of particular interest is the electroplating industry which coats metal products with layers of other metals of choice, for example zinc, chrome, copper, nickel or cadmium.

From an environmental point of view, the electroplating sector is highly relevant to target. The sector is also highly relevant from an occupational health and safety point of view. There are many 'twin-problems' of which problems in the external and the internal environment have the same underlying cause: the use of a toxic substance in the production process.

Many of the processes are relatively simple, require limited capital outlay, and only modest technical knowledge. A number of small companies are active, some with only a few employees and operating from interim facilities. The industry is also highly disorganised. Factors such as over-capacity in the sector, extensive price competition and general mistrust are barriers to the formation of an effective industry association.

By early 1999, a consultant had begun the task of defining the strategy and identifying the major elements of the project. The project document was completed by the end of 1999 and went into tendering in early 2000. Project implementation was initiated by mid-2000, at the same time as I left South Africa.

The metal finisher activity therefore constituted a good opportunity to carry out a case study of the activities that take place during the project preparation phase. The research activities were mostly participant observation, unstructured interviews, and documentary analysis.

I generally followed the consultant as a participant observer, sometimes taking active part in the activities. In the problem analysis phase this included visits to factories, interviews with representatives from industry associations, service providers and public authorities, as well as taking part in a so-called stakeholder workshop. I also joined the consultant in a number of meetings with the to-be project preparation committee and with Danced representatives. During thus activity, I sought to bring forward suggestions for how to introduce OHS considerations into the Project Document.

The same consultant was also involved in the planning of the CP project in the textile industry and I joined him in some these activities as well. However, the textile project was delayed for other reasons, and the observations that I made there are equally applicable to the metal finishing planning phase.

These research activities in this case study are generally similar to those of the other case study, i.e. mostly of a hypotheses generating nature, seeking to discover meaning. The general industrial setting is one of a mixture between a few large and well-organised hot-dip galvanising companies and a large number of small and medium sized enterprises (SMSEs) in a disorganised environment.

The OHS management system study

As the fish case study proceeded, a hypothesis slowly took form: that a potential manner of integrating CP and OHS would be integration at the level of methodology[18], that is, for large companies, integration at the management system level. However, as I went further into the topic of systematic OHS management, I was surprised to discover the almost complete lack of studies evaluating the effects of OHS management systems.

As chance would have it, a South African organisation, Nosa, partly financed through the workmen's compensation system, had developed a system for the systematic management of occupational health and safety. The so-called Nosa 5-Star system had been in operation for close to two decades. A number of the fish companies referred me to the Nosa system, and it was apparently in broad use in the South African industry.

However, the only study reported in the scientific literature, which was based on own empirical data, depicted that type of 5-Star systems as a sham, finding no evidence that the system was able to lower accident rates (Eisner and Leger 1988a). In Australia, the National Safety Council of Australia (NSCA) also operate a 5-Star safety rating system. Yet, in the year 2000, a report prepared by researchers at Victoria University for the National Occupational Health and Safety Commission on the effectiveness on occupational health and safety management systems (OHSMS) stated that "... several experts asserted »*they* [OHSMS] *don't work*« [...]. More common was conditional agreement that they could work, but » *the jury is still out*«" (Gallagher et al. 2000:21 emphasis in original). The report continues, "Very little empirical research has been done to evaluate the effectiveness of OHSMS" (ibid:22).

The following hypothesis therefore slowly took shape: A top-down management approach to occupational health and safety within a predominantly cost-efficiency discourse, such as the one by Nosa, is largely ineffective in improving the occupational health and safety performance of companies.

Should this hypothesis be true there would be very little reason to embark on a methodology-level integration strategy in the Danced CP projects. It was therefore decided to undertake a study evaluating the

[18] A discussion of the concept of 'integration' and how this may be accomplished is provided in the next chapter.

effect of the Nosa system in order to test this hypothesis. The first part of the research was based on participant observation as I joined the Nosa auditors and sat in as an observer during the star auditing sessions. I attended four Nosa audits in August – September 1999 amounting to 9 days of participant observation. On one occasion I was able to go back to the company after the audit had taken place and conduct unstructured in-depth interviews with a company representative on his perceptions of what had happened during the audit. Again, this activity is within the interpretative research tradition, seeking to discover meaning.

The second part was a comparative study of the accident performance of Nosa companies compared to general industry. This part is based on two cross sectional surveys. The first activity was a postal survey sent to all manufacturing companies in South Africa that had been committed to the Nosa system within a specified 3-year period, in total 399 companies. The second activity was sample survey of those companies' claims reported to the Workmen's Compensation system, drawn from that organisation's database. This research activity thereby positions itself in the positivist tradition of explanatory research, that is, a *hypothesis testing* research activity.

Baseline data on occupational safety in South African manufacturing industry were required in order to complete the explanatory activity above. A review of almost 30 years accident statistics combining data from various official sources was therefore undertaken. This research activity is of the positivist descriptive type. The quantitative parts of this research took place October 1999 – May 2000.

The Durban Club study

The last research activity in this study is related to a project that the University of Natal (Durban) was running with a so-called Waste Minimisation Club (WMC) of small metal finishing companies.

There are about 90 metal finishing operations in Durban, many of them small operations, the owner typically having an artisan background. Many are operating in a competitive jobbing market and they are not organised in any type of industry association. In 1997-1998 the Durban municipality embarked on an aggressive campaign to limit pollution from that industrial sector. The elements of the campaign were so stringent that the business owners felt it would effectively force all of the electroplating companies either out of business or out of town. Some of the electroplating company owners took the unusual step of organising themselves in order to challenge the authorities in a unified manner. A group of about 30 platers then formed a WMC with the aim of sharing experiences and knowledge on waste minimisation techniques. The WMC was set up on an experimental basis, backed mainly by researchers at the University of Natal.

As I have been informed, the Durban Club is the first example in South Africa of small and medium sized companies organising themselves in an information sharing network type organisation. Waste minimisation falls under the umbrella cleaner production concept and it would clearly be relevant to the present study if the Club would take on OHS issues as well. The Club accepted my proposal to make regular OHS presentations at their meetings.

The OHS approach chosen was that developed by the International Labour Organisation (ILO) in which OHS issues are tied to general productivity and cost efficiency interventions; the co-called International Program for the improvement of Working Conditions and Environment (known as PIACT, after its French name). The approach had been developed and tested in a SMSE environment in Asia (Thurman et al. 1994, Kogi 1990).

Important features of this approach are that 1) the activities are adjusted to meet real needs and local conditions, 2) through sharing and reinforcing positive experiences, 3) in an action-oriented environment that, 4) encourages participatory action. Learning from others positive experiences is a main strategy in this approach. This entails that the researcher prior to the presentations visits companies and familiarises himself with their operations and collects information on good practices already in place. With the permission from the company owner, the good practices are presented at club meetings along with more general OHS and productivity improvement information.

Over the period September 1999 – June 2000 fourteen factory visits were undertaken and unstructured interviews conducted. Two presentations were prepared. One presentation was given on two different sites encouraging the company owner to bring in employee representatives. Two presentations were given to the company owners at club meetings.

The interactions between the researcher and the company club members have been of a cyclic nature, first to collect information, then actively to intervene by providing them with specific information seeking to influence their behaviour, then to observe the effect, if any, that intervention had. The cycle then starts over again with collecting new information, intervening, etc. In this process, the researcher actively interferes with the subject of the research throwing overboard standard positivist quality criteria to research. This research thereby clearly positions itself in the action research tradition, actively attempting to bring about change, and where hypotheses are generated and tested on a continuing basis.

Chapter 3. Integration

Structurally different, yet inseparable

There are major structural differences between the areas of occupational health and safety and the environment. They are dealt with separately from a regulatory and enforcement perspective. This is partly due to the historical developments within to two areas, and partly due to different actor constellations.

The timing has been different. Worker protection concerns became a feature of the 1800s[19] while environmental concerns appeared on the scene about a century later. Occupational health and safety is widely regarded as an industrial relations issue in which only few actors groups have legitimate interest. This is in stark contrast with the sprawling actor constellations within the environmental area, which, for instance, could even include representatives from future, yet unborn generations. The two areas are regulated by two different state institutions, which have no particular tradition of co-operation.

However, studies also indicate that some companies, in particular the smaller ones, do not maintain a clear separation between the external and the internal environment. This is particularly true for the employees, who find it difficult to view workplace exposure issues separate from company emission issues (Rasmussen 1995:245).

[19] Indeed, the concept of an unsafe workplace can probably only be traced back to the dawn of industrialisation in the 1700s. This is not suggest that work was free from danger before the industrialisation but the conceptual separation between living and livelihood (working) had not yet been well developed. It was William Blake and Karl Marx who identified the degradation of labour in the Lancashire textile factories, the infamous 'dark satanic mills' of England. Marx' contribution was to describe the concept of unsafe workplaces in a theory of domination and exploitation. This new critical and pessimistic view of workplaces is, in my opinion, ever so evident in the work of Foucault, who has argued at length that the rise of the factory and the prison occurred simultaneously and involved exchanges between the two in the development of technologies of discipline and control (!) . Aldrich (1997), Peña (1997:25-30, 346).

This chapter attempts to examine in more detail what different options are available in an integration context. The chapter will first examine how the two areas relate to each other. It will then be argued that these relations call for an integrated approach. The concept of integration will then be examined after which various means to accomplish integration of OHS into a CP projects will be discussed.

Relationships

At the company level, Zwetsloot (1994:33-37) and Kamp (1997:29-31) identify and discuss different types of relationships between problems regarding working conditions and the environment. The characteristics of five such relationships are shown in Table 4 overleaf.

Twin problems are those in which a negative environment impact and poor working conditions can be traced back to the same root source, for instance the usage of a specific chemical substance or the use of a particular process or technology. The proper identification and dealing with twin problems is optimal as one intervention will produce benefits in both working conditions and in reduced environmental load. Twin problems are at the core of an offensive integration strategy -- seeking optimal solutions.

The relationships environmental, or working, conditions as a cause are essentially similar to the earlier discussion of **media shifting**. In this case the intervention fails to identify twin problems and therefore gives rise to new problems in the other field. Media shifting is at the core of a defensive integration strategy -- avoiding sub-optimal solutions.

A **missed opportunity** refers to situations where an intervention in the one field does not *produce* a new problem in the other field, but fails to alleviate one. The basic argument is one of sub-optimality. If, for instance, a process is redesigned to address problems in the one field, unrelated problems in the other field could also be solved at little or no *additional* cost. The identification of such opportunities is part of an offensive integration strategy -- seeking optimal solutions.

Indirect causal linkages are similar in nature to twin problems, the main difference being one of timing. Twin problems relate to the production process, indirect causal linkages take a life cycle approach.

Table 4 Type of relationships between problems regarding working conditions and the environment

Type	*Characteristic*	*Examples*
Twin problems	Problems in the fields of working conditions and environment arise from the same source	The use of pesticides in agriculture is affecting both farm workers and the eco-system The use of cyanide electroplating technology constitutes a hazard to workers and to the environment from extremely toxic cyanide. Organic solvents in the printing industry affect both the workers and the environment
Environ-mental conditions as a cause	The dealing with an environmental problem causes a new problem with working conditions -- media shifting	The installation of filters to limit emissions of harmful substances create a new occupational hazard when those filters must be serviced The replacement of non-toxic but ozone depleting CFCs in refrigeration units with highly toxic ammonia has created a new hazard in the workplace and a new hazard in urban areas from the road transport of toxic ammonia
Working conditions as a cause	The dealing with a workplace problem causes a new environmental problem -- media shifting	A ventilation unit creates a noise problem for the nearby local community Resolution of indoor climate problems for instance related to thermal comfort or indoor air quality lead to the installation of heating, ventilating, and air conditioning units that consume large amounts of energy, operate with toxic chemicals, and create environmental problems when disposed of.
Missed opportunity	The dealing with a problem in one area misses an opportunity to resolve a problem in the other area	Measures to reduce the emission of hydrocarbons at fuel depots and consumer outlets fail also to address ergonomic problems
Indirect causal linkage	Different stages in the life cycle of materials being relevant to working conditions and environmental problems	PVC plastics involve use of carcinogenic MVC during the production phase and constitute a hazard to the workers Softening agents in the PVC is a problem for the users of the product. When the PVC product is discarded, dioxin may be formed in the incineration plant and emitted to the environment

Based on Zwetsloot 1994:35, Kamp 1997:30-31

Defining integration

This chapter attempts to examine in more detail what different options are available in an integration context. The starting point will be to define integration not in terms of the form it takes, but in terms of what it does and what it attempts to bring about. Within this definition integration of OHS and environmental issues takes place, when:

- considerations about solutions within one field do not take place without simultaneous considerations about possible consequences for the other field.

Integration attempts to bring about the following benefits

- to achieve a better prioritisation and more efficient utilisation of the resources spent on OHS and environmental issues, because attention and higher priority is given to root problems that cause adverse effects within both areas -- an offensive integration strategy

- to prevent media shifting in which environmental problems are shifted to worker health and safety problems, or vice versa -- a defensive integration strategy

- not to overlook opportunities for improvements in e.g. the working conditions when environmental objectives are pursued, or vice versa -- an offensive integration strategy

- ideally, to achieve synergy effects; environmental work can benefit from the workers' involvement in OHS work and their detailed knowledge of the production processes; and OHS work can benefit from the top management leadership and attention usually reserved for environmental work only -- an offensive integration strategy

Having defined integration in terms of what is to be achieved, the discussion will then turn to how integration can take place. Before this discussion can take place however, a conceptual model of organisational change will be outlined.

A simple conceptual framework for integration

Leavitt (1965) provides a conceptual framework that identifies four distinct, yet interdependent, variables in an organisation that must all be considered if organisational development is to be effective (Figure 4). Few people would argue that the model is overly complex or sophisticated. Rather, the model appears to be decidedly simplistic. Yet, the value of a model lies with its ability to guide concepts and analysis, not with its level of sophistication. Leavitt's conceptual framework for analysing organisational change has passed this test by

providing a foundation for earlier work[20] concerned with identifying different types of and levels of integration.

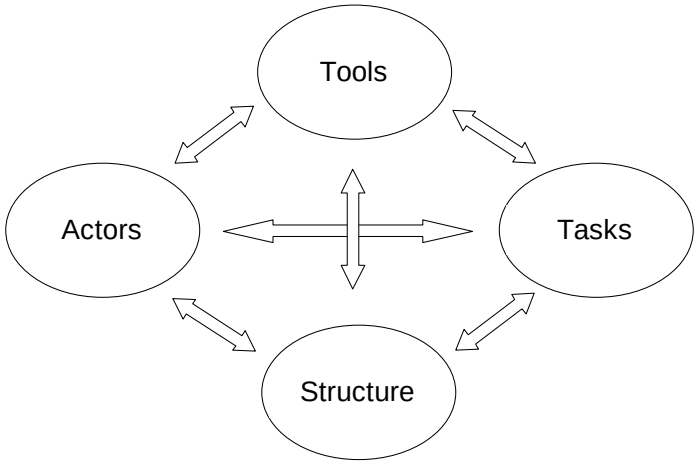

Figure 4 A simple model to analyse organisational change

Source: Leavitt 1965:1145

An organisation is producing some sort of goods, material or immaterial, which are in demand from the external world, the organisation's raison d'être. To produce, a series of *tasks* must be accomplished by the people (*actors*) in the organisation. They do so within an organisational *structure* defining the division and co-ordination of subtasks as well as hierarchy and lines of authority. The people (actors) carry out their work using different types of technology (*tools)* broadly defined as hardware tools, skills and knowledge, or specific methodologies of work, for instance a systematic approach to problem analysis and solution.

Leavitt's main point is that these four subsystems are highly interdependent and that any change in either one system must be accommodated by change processes in the other three as well. In other words, successful organisational change must involve a unified and coherent change approach involving all four components. With this conceptual model as a starting point three major understandings, can be identified of how to change the organisation's tasks so that greater emphasis is placed on OHS or environmental issues. These understandings focus in turn on tools, actors, and structure.

[20] This framework forms the basis for integration discussions in e.g. Kamp (1997), Rasmussen (1995), and probably also Broberg (1997).

Applying the framework to identify means of integration

Looking at tools

The 'tools' (technology) concept is broad, comprising the knowledge and skills of the people in the organisation and of the methodologies they make use of when dealing with their tasks. The prime areas of concern are those of planning and decision making.

In order to make informed decisions people must have *information* and knowledge about the issues that they confront. This is normally provided for in the OHS legislation, which comprises right-to-know clauses, for instance a right-to-know about workplace chemical substance hazards. This includes information on the hazardous nature of the chemicals in use (e.g. labelling symbols) and material safety data sheets (MSDS) with e.g. information on recommended work practices to be followed. Within the tools domain, an OHS intervention could for instance start with an information campaign to inform the workers of their rights as specified in the national legislation.

The tools subsystem also comprises knowledge about *methodologies* which assist decision making. This could for instance comprise guidelines on how to undertake a systematic review of ergonomic risks and a methodology on how to rank those risks according to their severity. It could be a 'catalogue of ideas' on how certain classes of problems had been successfully dealt with in other companies.

The example that follows is taken from the Danced fish CP project. The project comprises a study tour activity, which deals specifically with information and knowledge. "The candidates participating in this training should be fully equipped to go-back-home and make environmental assessment of their own companies; their *toolbox* should therefore also include a generic Terms of Reference for such plus the format for applications to Danced [...] for incentive grants. Other useful '*tools'* could be manufacturer's catalogues, lay-out examples, compendium of key figures on equipment water usage, environmental key figures (energy per ton raw material, etc.)" (Danced 1998, p 3-7, emphasis added).

The understanding of an organisations behaviour will therefore be embedded in a *rational choice discourse*. Decision making is seen as a sequential process, advancing in certain phases and managed by key point decisions. The goals of the organisation are assumed to be unambiguous and people are assumed to agree on and strive to achieve those goals. People are assumed to decide and behave in a manner more or less consistent with rational choice theory[21].

[21] This theory and a contrasting one are discussed in more detail in the next chapter from page 62 and onwards.

It is true that criticism[22] has been raised concerning the apparent inability of people to act in manners consistent with rational choice theory. Nonetheless do interventions that focus on the provision of information, and supporting of the decision making process by providing systematic methods, manuals, guidelines etc, have great appeal. Many consultants develop and market proprietary 'systems' and 'tools', which assist in systematising information, ranking alternative scenarios, deciding which issues to deal further with, and which to let go. Most of the United Nations CP guidelines and most textbooks on both environmental and OHS issues fall within this technology (and rational choice) approach.

A clear example of this tools approach can be found in the Danish EPA's project 422 which reports the development of a 'tool box' that couples environmental knowledge with management decisions. The report states: "The present environmental situation of the company, the level of ambition of the management as well as the available resources are always decisive for the prioritization. Consequently, the tools focus on the possibilities for the company to systematically evaluate the importance of each individual environmental impact as well as to prioritize its environmental effort and render visible the reasons for the choises (sic) made by the management. Thus, the tools support the company in elaborating a basis for decisions intended for the prioritization by the management of the environmental effort." (Nielsen et at. 1998:eng. summary)

Another clear example of the tools approach can be found in Danida's guidelines on how to ensure that *environmental* issues are considered in Danida's *development* projects (Danida 1994), i.e. a quite related agenda of integration. The target group of the guidelines are "Embassy staff and country desk officers" (ibid:2), i.e. the persons who shall use the methodology outlined in the guidelines. The guidelines' point of departure is the standard planning tool, the Project Cycle tool, into which additional analysis of environmental issues shall be undertaken; for instance an overall environmental policy check, an environmental screening, an environmental assessment, an environmental appraisal, etc. Projects are classified into three categories according to their likely environmental impacts, so-called black, grey and white projects; black projects are given a full range of environmental assessments and appraisals; white projects minimal, and so on.

In much the same vein, guidelines on how to integrate OHS into Danida development project have focussed on integrating working environment assessments (WEAs) into the project cycle (Hasle and Nielsen 1994). Project are again classified into three categories: black, grey, and white. Black projects are given extensive WEAs and white projects minimal WEAs (ibid:31). The focus is on 'tool kits' for screening, for assessments etc.

[22] See for instance March (1994, 1999), Rasmussen and Jensen (1994).

Looking at actors

If we try to understand an organisation in term of the actors, or people, in the organisation, the unit of analysis becomes the individual person and the issue of interest becomes the patterns of social interaction between those individuals. The goals and objectives of the organisation are then no longer the prime field of interest, rather how the people perceive those goals and objectives. Nor is it taken for granted that all individuals pursue the same goals. It must be accepted that there is a general disagreement on goals and that conflicts of interest are legitimate and play a major role in shaping the behaviour and informing the decisions of people.

The understanding of an organisation is therefore embedded in a *social systems* discourse. The focus is therefore on the building of formal as well as informal alliances amongst actors, on processes of negotiations and re-interpretation of goals, and of reaching compromises between actors who pursue different agendas. Decision-making is no longer perceived as a linear process, advancing in a sequential manner, informed by key decision. Rather, decision making is better understood as an iterative or cyclic process in which goals are uncertain and re-interpreted, and decisions are the outcome of coalition building, negotiation and compromise between key actors.

Within the OHS field, an 'actors' approach can be identified in OHS legislation that mandates joint safety committees at the workplace, thus establishing an organisational platform for workers where they can safeguard their interests in negotiations with management. OHS legislation in most countries have provisions for such joint liaison committees, following the recommendations of the highly influential UK Lord Robens committee of inquiry, that: " The primary responsibility for doing something about the present levels of occupational accidents and diseases lies with those who create the risk and those who work with them" Robens (1972:7).

An 'actors' approach is also clearly identified in a Danish research project on employee participation in the preventive environmental activities at firm level. The overall purpose is to improve the quality of the preventive activities and to entrench the focus on prevention in the organisation. However, the purpose is also explicitly to ensure that OHS issues and environmental issues are considered at the same time (Aldrich et al. 1995:18), i.e. an integration agenda.

The instrument to achieve these ends is to introduce an actor group onto the arena where negotiations and decisions take place. Integration is expected to be a more or less natural consequence of their participation because it is in the self-interest of this group of actors to safeguard OHS interests while at the same time deal with environmental issues.

Looking at structures

Finally, organisational behaviour may be understood in terms of the organisation's formal structure, which it is usually at display in its organisation charts. The focus will then be on the division and co-ordination of tasks and the management structures that oversees, controls and maintains it. An important issue is how resources are allocated within the organisation. The focus is on the organisation's mechanisms for reward and punishment, on how goals and objectives are communicated, on formal responsibility, on any financial incentives (or disincentives) which could influence motivation, and finally but not least, on the mechanisms of accountability in use that serve to measure and keep people accountable to meeting agreed targets or objectives.

Understanding organisational behaviour as an *organisational process* underlies commonly heard dictums such as "The first essential step is to obtain top-level management support and then to use this to leverage broad-based support". If top-management level support is not secured, the argument goes, the project will be starved of resources, will fail to meet its targets and most probably collapse. Securing top management's support is also necessary to establish the issue as a legitimate objective that the organisation should pursue.

Guidelines on how to implement safety management systems provides a clear example of this approach in its recommended three-tier approach. First, a so-called Key-Advocate (an executive in top management echelons) must be identified and his support won. This individual will endorse the initiative, support the goals and provide the necessary resources. Second, support must be won from the so-called Prime-Mover or Sponsor in the upper management structure, for instance a division manager. He will oversee the initiative and supervise the resources. Third, ownership for the actual project lies with the Champion who drives the initiative and makes things happen (CCPS 1993:9).

Similarly, the dominant tool for project planning and control, the Logical Framework Approach (LFA), relies heavily on the specification of unambiguous, specific, measurable, and time-based objectives which are used as instruments to maintain and enforce accountability for achieving project success.

Guidelines on how to integrate OHS into Danida development projects also have 'structure' elements, beyond the 'tools' elements that were mentioned earlier. For instance, the guidelines recommend that working environment assessments (WEAs) are to be included in the contractual documents, the so-called Terms of Reference (TOR), in the project identification' stage[23]. "The embassy or country desk are responsible [for this]" (Hasle and Nielsen 1994:32). The focus is thus

[23] Chapter 4 gives an overview of the special parlance in use in development agencies, project life cycle stages, Logical Framework Approach, etc.

on the setting and communication of objectives, on allocation of formal responsibility, on the contractual specification etc.

Combining the discussion of Chapter 2 of the empirical field, that is, of what constitutes a cleaner production project, and the discussion above of the different means of integration, the following summary can be produced.

Summary -- means to integrate OHS into CP projects

We can now combine the discussion of Chapter 2 of the empirical field, that is, the discussion of what in effect constitutes a 'cleaner production project', with the analysis and discussion above of the different means of integration.

The summary that follows below is sketchy and seeks to establish a broad range of options for integration. It is probable that not all are feasible, either for reasons of economic efficiency or because they may be incompatible with the user-orientation of international assistance projects, that only 'demand-driven projects' are implemented. This is a different discussion. For now, the concern is to establish the range of options. Two distinctions are made. The first distinction follows the conceptual framework laid out above: integration at the tools, actors, or structure level. The second distinction concerns which area of the empirical field that is targeted: is it integration in the Danced organisation, or is it in the web of activities that are subcontracted to agents.

Integrate at the *Tools* level

Conceptual basis

An understanding organisational behaviour in a rational choice context

In the Danced organisation

Integrate OHS into the *project planning tools and manuals* in use in Danced, notably the Project Cycle and the Logical Framework Analysis. For instance, specify in these planning tools that the following activities must be undertaken:

- an overall working environment policy check,
- a working environment impact screening,
- a working environment impact assessment,
- a working environment impact appraisal, etc.

Specify a methodology ('tool kit') to identify and asses working environment impacts, rules for how to classify an impact into three categories depending on severity, black, grey and white projects; etc.

In the activities that are undertaken by agents (consultants)

Integrate OHS in the same methodologies that the cleaner production projects employ. For instance, if a cleaner production project embraces the common management methodology of identify–analyse–prioritise–implement–check, to achieve its objective, then integrate OHS into this methodology.

This is integration at the *level of methodology* of the intervention. This is a major theme of this study, which will be examined in depth in chapters Chapter 7 and Chapter 8 for large and small companies, respectively.

Integrate at the *Actors* level

Conceptual basis

Understanding organisational behaviour in a social systems context

In the Danced organisation

Modify (enlarge) the actor system to ensure that OHS interests are continuously being safeguarded. Introduce an actor into the Danced organisation who can look after OHS issues, monitor opportunities and act as a resource person with in that organisation.

In the activities that are undertaken by agents (consultants)

Introduce an actor that can safeguard OHS interest while the project is being implemented and who can grab unexpected opportunities for integration as they arise.

Strengthen local actors who have interests in OHS, for instance the workers and/or workers' unions

Modify (enlarge) the actor system to ensure that OHS interests are being safeguarded on a continuos basis and who can grab unexpected opportunities for integration as they arise.

Introduce an OHS actor:

- during project identification (OHS expert)
- during project implementation (OHS expert)
- during project life, e.g. an OHS representative to sit in project preparation and project steering committees

Give access to local actors who have interests in OHS, for instance the workers and/or workers' unions

Strengthen local actors, for instance by provide them with technical knowledge or train employees so they can perform more efficiently in negotiations

Pursue employee participation in CP projects

Integrate at the *Structure* level

Conceptual basis

Understanding organisational behaviour in an organisational process context

In the Danced organisation

Define OHS a as prominent and legitimate objective of the Danced organisation. Define it in the Vision Statement and espoused policy, in the Strategy Papers, etc. and communicate this in the organisation

Specify and assign clear formal responsibility that also include OHS into the job descriptions of Danced employees.

Establish mechanisms of accountability that keep Danced employees accountable to achieving that OHS is being considered in CP projects

Make OHS issues explicit and mandatory in the written specifications that control activities by subcontractors. Specifically:

- Introduce OHS as a legitimate objective in the TOR of CP projects
- Specify OHS objectives in the CP Project Document
- Insert appraisal events in Project Cycle tool, in which checks for OHS are conducted

In the activities that are undertaken by agents (consultants)

Make consultants accountable to achieving OHS objectives (and not only accountable to achieving environmental activities)

Integrate in reward, punishment structures and employ accountability. Defined criteria for determining upon project completion if the CP project was successful in achieving its OHS objective

Specify mandatory OHS skills and activities in contractual documents

Chapter 4. Planning in environmental assistance projects

Introduction

Development agencies, of which Danced is one, are extensive producers and consumers of formal planning tools and methodologies. Such donor agencies administrate large amounts of cash on behalf of parliament. They develop policies and strategies that conform with the mandate given by parliament, they negotiate with governments of the recipient countries on strategies and priorities, and they run or administrate a large number of diverse projects, each with its own budget, objectives, and time frame. Additionally, much of the actual work regarding project planning, implementation, monitoring and evaluation is subcontracted to third-party agents, for instance non government organisations (NGOs) or consultants. In short, a complex affair which requires great deal of planning and co-ordination.

The reasoning presented in Chapter 2 (page 19) identified three key features of this system:

- First, that there are multiple principal-agent relationships, that is, contractual arrangements between a principal (the donor) and an agent acting on behalf of the principal.

- Second, that there are manifest forces at work that tend to fragment activities and disorganise the process, in particular the many interfaces and the lack of continuity arising from the use of different consultants in the same project.

- Third, that this fragmentation leads to a heavy reliance on written documentation as the carrier of information and continuity.

The implication is that the controls are of a bureaucratic and hierarchic nature. Development organisations manage their projects almost exclusively through written specifications. A multitude of actors may undertake the actual work, often in competition with each other based on parameters of price and professional capability. The project specification, primarily as laid down in the *Project Document*, is the principal means of control, meant to assure continuity and consistency over the project's life cycle.

This chapter will review and describe major features of the dominant planning methodologies that development agencies use to produce those written specifications and to manage their many projects accordingly. The purpose of this descriptive exercise is to prepare the ground for the two case studies of the Danced fish and metal finishing CP projects in Chapter 6, which deal with the planning and implementation phases.

The chapter will then present two major, and competing, sets of theories on planning. It will be argued that the dominant planning tools in use in Danced are consistent with 'rational choice' theories of organisational behaviour. In particular will it be argued that the LFA planning tool has unmistakable roots in Scientific Management and Taylorism. The competing set of theories will present an alternative perspective on planning that primarily serves to soften the hard core of rational planning methodologies. The quite controversial view, that certain problems escape rigorous planning efforts, will be presented. The chapter will close with a broader view on the benefits of planning, that includes not only the face-value objective of improving efficiency, but also that planning may serve as instruments to legitimise organisational decisions, acting as means to shield the organisation from blame from its rivals or foes.

Planning tools in use by Danced

Two dominant planning tools

Danced employ two major tools to assist project planning and management. The first tool is the Project Cycle (PC), which is mostly used *inside* the Danced organisation as a general project management tool -- an approach to manage a project from cradle-to-grave, so to speak. The second methodology, the Logical Framework Approach (LFA), prescribes a set of 'good practices' to follow when a new project is being conceived and detailed. The LFA tool also serves to assure consistency in the planning efforts, which is particularly necessary when this task is subcontracted to consultants that are selected from competitive bidding procedures.

The LFA planning tool is particularly relevant for this study because it comprises a methodology to use in the *project definition phase*. It will later be argued in Chapter 6 that proper attention *must* be paid to OHS issues in that initial project definition phase if they ever are to gain foothold in the project at its later stages. The description that follows will therefore provide a relatively detailed account of the approach to problem analysis and project design that the LFA prescribes. Other aspects of the LFA will be considered to the extent that they are important for an understanding of the problem analysis and project design activity. Similarly will only passing reference be made to the Project Cycle to the extent that it supports the description of the LFA.

It should be observed, however, that the LFA methodology is highly integrated. It is so by design. It is a deliberately sought feature of the LFA that it shall guide the activities over the entire lifecycle of the project. For instance, the mechanics of the LFA are such that the *outputs* of the planning process are structured in a manner that allows them to be used directly as *inputs* in later progress monitoring activities. The LFA planning tool thus serves the dual purposes of planning and subsequent project monitoring and management. Conceptually, it thereby becomes a supplement to the Project Cycle methodology.

Adherence to the LFA methodology is a major strategy of development assistance agencies in Denmark and other countries. It is mandatory to apply LFA methodology when designing new development assistance projects. The guidelines for project preparation specifies that the LFA activity must be documented and included in the documentation forwarded to the development assistance agency when funding is applied for. Hence, an analysis of this tool, of its epistemological foundation, of how it interferes with the process of project definition is central to a deeper understanding of development assistance projects.

Why plan ?

The two quotes below capture quite precisely the nature of the perceived problems and the rationale for more formal approaches to project planning and design:

> " ... evidence of *inadequate project designs* have surfaced with regular frequency. The problems are numerous. They include implementation delays, cost overruns, changes in objectives, unforeseen effects of activities, failure to include intended beneficiaries and so forth. Project planners have often overlooked the dynamic environment of political factors, social interactions and the complex and uncertain nature of development problems" (Danida 1990:1, emphasis added).

> "*Inadequate planning* is a persistent fundamental problem in international development aid. Planning documents are often specific and clear as to the physical and financial inputs, personnel, activities and expected physical results. But thorough assessment of the overall objectives, the target group and the external factors which determine success or failure is often lacking. ...[...]... As a result, projects often develop in unintended directions, and fail to respond to the needs of the intended beneficiaries. Projects may have unforeseen negative results which could have been avoided with more systematic planning. ...[...]... There is ample evidence to show that a modest investment in *improved planning usually pays off* in terms of better projects and direct savings. In many cases the

> rewards can be considerable" (NORAD 1990:3, emphasis added).

It is evident that the argument is one of improving efficiency. In fact, the LFA methodology was specifically conceived as a response to the problems listed above (Norad 1990:3).

The Project Cycle

The project Cycle (PC) establishes a conceptual framework for systematically dealing with a project over its entire life, from the first inception to its conclusion. This tool serves to aid donor agency staff to manage projects systematically and consistently.

The PC divides a development project into three distinct phases: preparation, implementation and completion. A simplified project cycle comprises more than ten distinct steps that are assumed to proceed sequentially. Based on Mikkelsen (1995:49) they are:

Project preparation
- identification
- pre-appraisal
- feasibility study
- appraisal
- prepare project document
- agreement and contract

Project implementation
- monitoring
- review

Project completion
- transfer to normal administration
- termination
- evaluation of project
- evaluation of impact and of potential for replication)

A graphical illustration of the project cycle is shown on Figure 5 overleaf.

LFA -- tracing its origins and developments

Danida's LFA manual (Danida 1990:5) observes that the ancestor to the LFA was the so-called Logical Framework (LF), which was developed by USAID in the late 1960s. Since then, several donor organisations including FAO, ILO, GTZ (the German development agency), and others, first adopted it, later modified it and made further developments. Danida eventually decided to introduce the methodology in 1989.

In its early version, the Logical Framework was mostly descriptive -- a *matrix* that systematically organised and described project objectives, outputs and inputs, important assumptions, indicators, and means of verification. Developments of later versions of the tool were particularly concerned with improving its analysis and planning capabilities (Danida 1990:1-5).

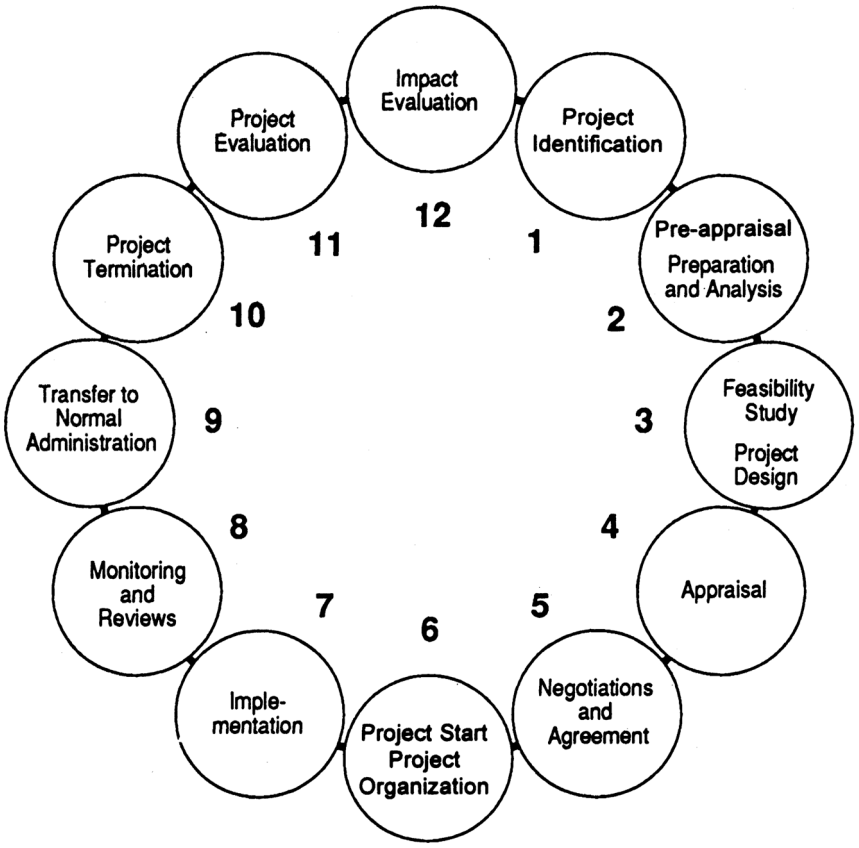

Figure 5 The Project Cycle

Source: Mikkelsen 1995:49

Each new version of the LFA tool has thus seen a broadening of the scope. The rather limited scope of the so-called first generation LF was mainly descriptive -- enhancing the project documentation by providing a methodology for a systematic, standardised and comprehensive description of a development project. The second generation combined a problem analysis with an analysis of objectives. In its third (and present) generation, LFA has evolved into a general tool for managing and monitoring projects as well as a tool to enhance stakeholder communication (Bech-Hansen 2001).

While each generation of the LFA tool has sought to increase its planning content, it is still a key purpose of LFA to provide a standardised project description.

LFA -- aims and structure

We can therefore identify the following aims of the LFA tool

1. To guide the *problem analysis* activity, ensuring that key problems are identified and addressed in a standardised, systematic and proper way, ensuring consistent planning effort across projects and over time, and not the least to lay down some minimum requirements to written documentation of these project analysis activities

2. To guide the *project design* activity, ensuring that the activities of the project address the key problems in an efficient manner, again while meeting the same requirements to a systematic and consistent approach, and written documentation of the process

3. To *describe* the project in a standardised, systematic, consistent and comprehensive manner that highlights logical linkages between inputs, activities and results, and also identifies important assumptions and risks. This description must have sufficient detail and precision to serve two major purposes:

4. First, that the description can form the contractual basis for a competitive tendering procedure. Subcontractors who wish to implement the project shall be able to estimate the time and effort necessary to do so and make a commercial bid based on this description. Subcontractors will scrutinise this description when making their bids, because the successful subcontractor is chosen from a competitive bidding process.

5. Second, that the description specifies in detail the objectives that are to be achieved and the *indicators* to verify that objectives have been met upon project completion. The description will therefore also form the basis for a subsequent evaluation exercise - - both of the project and of the subcontractors performance. This evaluation exercise can be carried out by a subcontractor, again chosen from a competitive bidding procedure.

In summary, the LFA deals with systematic problem analysis and project design. It structures the project description enabling this information to form the basis for implementation and subsequent monitoring and evaluation activities. LFA thereby becomes an integrated tool that embraces not only the planning phase, but also pervades the implementation and completion phases - the entire Project Cycle.

The LFA is divided into two phases and seven steps. Four steps concentrate on analysis, three steps on design as follows (after Mikkelsen 1995:50):

Analysing the situation

1 participation (stakeholder) analysis
2 problem analysis
3 objectives analysis
4 analysis of alternatives, formulation of strategy

Designing the project

5 identification of project elements
6 identification of external factors (assumptions and risks)
7 identification of indicators

LFA -- the analysis phase

The LFA is an *objectives oriented* project planning and management tool. The identification and specification of objectives are the core tasks of the project analysis phase. It comprises four steps:

The first step is to identify major stakeholders. If possible, stakeholder representatives should be involved in the next core step (step 2) of LFA - the problem analysis - in which problems are identified and causal linkages elucidated. The LFA guidelines stress that a problem be defined as an existing negative state, not as the absence of a solution -- thus "lack of pesticides" is not a problem, whereas "crops are infested with pests" is. Problems are then structured according to causal linkages among them.

This produces a rough but structured model of the problem environment. The output of this exercise is visualised in a problem hierarchy, the so-called problem tree. Figure 6 shows an example. The core problem is placed in the centre, in the example the core problem is that bus accidents happen too frequently. The causes of this negative situation branch out below the core problem: drivers are not careful, bad condition of road etc. The effects branch out above the core problem: passengers are injured or late, leading to overall loss of confidence in this particular bus company.

The problem analysis step of the LFA thus combines idea generation and brainstorming activities with structure and analysis. The active involvement of stakeholders, or their representatives, in the discussion and analysis that eventually lead to generation of the problem tree is also a consensus building activity. The participants reach a common understanding of the problems to be addressed, how, and under what constraints.

The third step, objectives analysis, takes its input directly from the problem analysis. Problems, which were formulated as existing negative states, are simply rephrased into positive statements. This

procedure transforms the cause-effect problem tree into a means-ends tree in which problems are transformed to objectives (Figure 7).

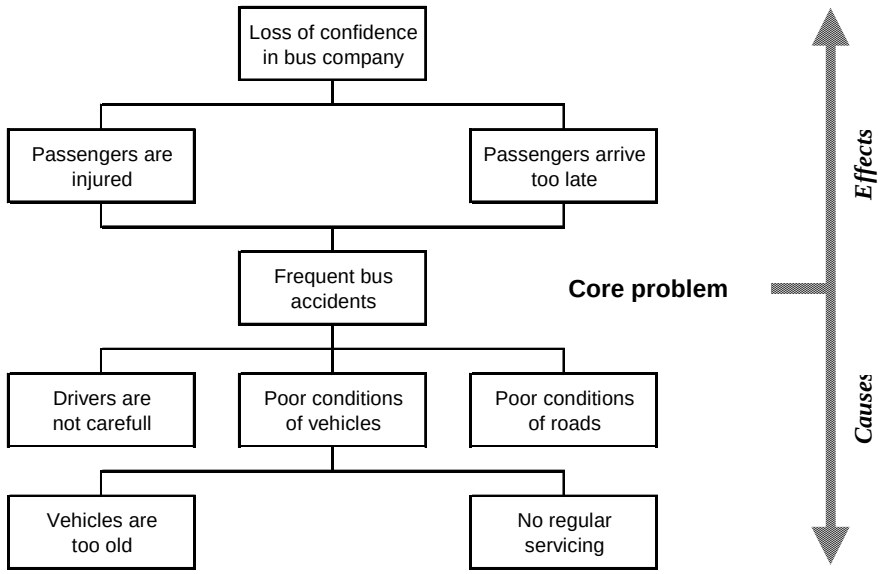

Figure 6 The LFA problem tree (step 2) outlining cause-effect relationships

Source: After GTZ (1991) as quoted in Mikkelsen (1995:53)

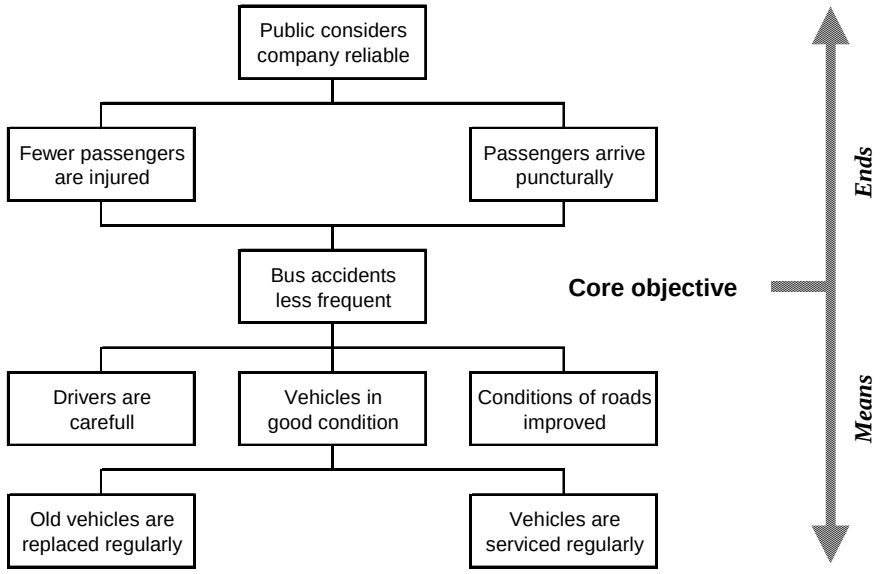

Figure 7 The LFA objectives tree (step 3) is obtained by inverting the problem tree

Source: After GTZ (1991) as quoted in Mikkelsen (1995:54)

In the example, the core *problem* that bus accidents happen too frequently is inverted into a core *objective* of less frequent bus accidents. The specific negative *cause* of poor conditions of vehicles is inverted into a positive *means* of bringing the vehicles into good conditions. The negative *effect* that passengers are injured is inverted into a positive *ends*, that fewer passengers are injured, ultimately leading to better public confidence in the bus company.

The next step in the LFA (step 4)is to isolate a number of alternative scenarios (or strategies) from the problem tree. Each alternative scenario is assessed on a range of parameters, for instance the costs of the scenario, its chance of success, its time horizon etc. An overall scoring and ranking exercise then permits the best alternative to be chosen.

An example of this analysis, scoring and ranking of alternatives is provided in Table 5 below. Scenario 1, better drivers, score consistently more favourably than scenario 3, better roads. Costs are lower, the chances that the project will complete successfully is higher, results are achieved earlier, etc.

Table 5 Alternatives analysis (LFA step 4). Scenario number 1 appears to be the most attractive alternative

	Scenario		
	1	2	3
Parameter	Better drivers	Better busses	Better roads
Cost	low	medium	high
Chance of success	medium	medium	low
Benefit / Cost ratio	medium	medium	low
Time horizon	short	medium	long
Social risk	medium	medium	medium

Source: Bech-Hansen 2001

This extremely simplified account of the LFA methodology is described here to demonstrate the conceptual logic that pervades the planning tool -- how systematic analysis and application of a structured approach will guide a group of people to

- potentially identify a multitude of problem in a brainstorming exercise
- identify and agree on a single one as the core problem

- identify causes and effects and highlight logical relationships
- transform problems into objectives, that is, identifying which objectives an intervention should have
- transform causes into means, that is, identifying the inputs that the intervention must provide or bring about,
- transform effects into ends, that is, identify the results that the intervention must produce
- analyse intervention alternatives and pick the most optimal one.

LFA -- the design phase

After having conceived the strategy the LFA activity moves into its second phase, designing the project. The design phase comprises three steps, as noted earlier

Designing the project

5 identification of project elements
6 identification of external factors (assumptions and risks)
7 identification of indicators

The purpose of the design phase it to structure the main elements of an intervention, highlighting the logical linkages between intended inputs, planned activities and expected results. The design phase shall also identify and organise important assumptions. Additionally, it shall specify indicators, and means of verification, which shall assist subsequent evaluation activities.

This entails setting up a hierarchy of objectives, with the so-called development objective at the top, followed by the immediate objectives, project outputs, etc. For each of these objectives, key assumptions and risks are identified which could hinder that objective in being achieved. In addition, indicators are listed which serve as means of verification if objectives have been fulfilled.

The final step is to compile this information into a project matrix (see example in Table 6). The project matrix is the condensed output of the LFA exercise.

The purpose of this step-by-step exercise, which is sometimes called the LFA workshop, is to ensure that the following two fundamental requirements are fulfilled:

1 a minimum degree of consensus is reached between stakeholders over what the basic problem to be addressed

2 the problem is formulated in such a way that it can be addressed by specific interventions - i.e. the problem is

analysed in its entirety, specifying causes and effects (Mikkelsen 1995:50)

Table 6 The LFA project matrix -- a systematic and comprehensive description of project contents

DEVELOPMENT OBJECTIVE High service level for bus passengers	**INDICATORS** 90 % of departures with less than 5 minutes delay Company's market share on the increase	**EXTERNAL FACTORS** Passengers continue using company buses
IMMEDIATE OBJECTIVE Frequency of bus accidents reduced	**INDICATORS** Less than x accidents annually after 12 months Less than y serious injuries after 12 months	**EXTERNAL FACTORS** Road conditions are improved
OUTPUTS 1. Drivers trained 2. X new busses operational 3. Maintenance workshop equipped 4. Maintenance routines established	**INDICATORS** See opposite page	**EXTERNAL FACTORS** Trained drivers remain with the bus company
ACTIVITIES 1. Undertake training programs 2. Procure buses 3. Procure tools and spare parts 4. Develop maintenance routines	**INPUTS** 1. Bus instructor x months 2. Funds for busses 3. Funds for tools and spare parts 4. Maintenance instructor y months	**EXTERNAL FACTORS** Tool and spares supplied and cleared in time

Source: Norad (1990:102)

A few additional purposes/benefits of the LFA project matrix can be listed

3 that a hierarchy of objectives has been defined which permits later differentiated evaluations of project success. At what level were objectives met? - for example did project outputs materialise but without achieving the immediate objective etc.

4 that the indicators to verify if objectives have been met, and the means of obtaining these indicators, have been agreed upon prior to project execution. In this manner the project matrix bears resemblance to the making of a contractual arrangement, a detailed specification the inputs required to achieve certain outputs, accompanied by criteria of how to measure inputs and outputs, together with a timing schedule.

5 the LFA project matrix structures information in a manner which permits its direct use in subsequent project monitoring and evaluation activities.

LFA - indicators

Indicators function as measures of output and impact and as proxies for attainment of objectives, indeed, the availability of indicators is a key precondition for the use of planning-by-objectives methods such as LFA. The proper definition of indicators thereby becomes a task of key importance for the project planners.

It may also be expected that the project implementation consultant will scrutinise the indicators well cognisant that those indicators will form the basis for the subsequent evaluation of their success (or possibly, failure) in achieving project objectives. Indicators become politically charged issues. I will revert to this point at a later stage. Various authors therefore deal with indicators in detail. Mikkelsen (1995) note that *ideally*, indicators are objective and specific measures of the result of the project. Indicators of output are usually simple, e.g. numbers of units produced, persons trained, etc. However indicators of the fulfilment of objectives may be complex, if at all possible, and in such cases must qualitative and less objective assessments be relied on.

A good indicator is said to be 1) substantial in relation to an objective, 2) independent at the different levels of objectives, 3) factual rather than a subjective impression, 4) plausible, and 5) based on obtainable, preferably existing data. (Mikkelsen 1995:89 quoting Norad and Danida sources). In development agency parlance, the ideal indicator is SMART, that is: Specific, Measurable, Achievable, Realistic, and Time-based (Bech-Hansen 2001).

This brief and highly simplistic review can off course not do justice to the full complexity of the LFA method. In its full elaboration the LFA is a major task which by intrinsic definition should comprise an all-

inclusive problem analysis, covering all relevant conditions and every conceivable major external risk to successful project completion. However, the review suffices to provide an idea of the mechanics of the method, the tempting simplicity of its stringent conceptual logic, the emphasis on bureaucratic controls through indicators, and a hint at the method's epistemological underpinnings.

Theories on planning

Taylor and scientific management

An account of planning cannot escape[24] the contributions of Frederick Winslow Taylor (1856-1915) who greatly influenced the methods of production planning and of workplace organisation. F.W. Taylor was an American industrial engineer and sheet metal expert who gained fame with a production concept based on task specialisation and bureaucratic rule in the early 1900s. He has given name to a set of manufacturing principles known as Taylorism, or what Taylor himself referred to as the Scientific Management of work.

One of Taylor's greatest concerns was that workers tended to restrict output by deliberately slowing down the pace of work - 'soldiering' as he named it. In the late 1800s, craft workers exercised considerable autonomy over their labour and their helpers. Taylor recognized, for instance, that the Midvale Steel Company's machine shop, during the late 1870s, "was really run by the workmen and not by the bosses. The workmen together ... carefully planned how fast each job could be done..." (Taylor 1912, quoted in Taksa 1992:384). Workers could uphold systematic soldiering by various means of peer pressure, harassment or physical confrontation. 'Binging' was one of those means -- a too productive worker (a quota violator) was ridiculed by co-workers or threatened with social exclusion or physical punishment, which could include a slap ('bing') to the head of the rate-buster (Peña 1997:345). Taksa (1992) attributes the soldiering phenomenon to a deep rooted perception on the part of the workers that increases in productivity will result in employment insecurity, and is to be resisted.

In order to control this counter-productive behaviour Taylor sought to establish a system where management could exercise full control over the work processes. His first step was to decompose complex work operations into smaller sets of standardised tasks, which could be carried out independently of each other. These new standardised tasks required only modest training to carry out and reduced the dependency on skilled artisan workers. Workers could not only be shifted between different work tasks more easily -- it was also relatively unproblematic to take in new hires and train them to fill in for experienced workers in case of industrial conflict.

[24] Indeed, I will argue in one of the next sections, that LFA has unmistakable roots in Taylor's Scientific Management.

Taylor's quest for absolute managerial control over the work processes and of the knowledge and skill required to carry out work is evident in the following quote: "The managers [must] assume ... the burden of gathering together all of the traditional knowledge which in the past has been possessed by the workmen and of classifying, tabulating, and reducing this knowledge to rules, laws, formulae .... All possible brain work should be removed from the shop and centered in the planning or laying-out department .... The work of every workman [must be] fully planned by management in advance. " (Taylor 1911, quoted in Peña 1996:342)

The hallmarks of Taylorism are thus a distinct separation of mental and manual labour, a separation of the planning of task from their subsequent execution, which relies on hierarchical command structures and bureaucratic rules to co-ordinate and control work. Taylor perfected these manufacturing principles with the development of the time and motion study in which every movement is identified and optimised. When tasks are so precisely defined in terms of movements, operations and the time required to carry them out, they become a powerful tool to measure and control the execution of work.

Taylor thus established powerful principles to measure and control the execution of work. It is probably difficult to underestimate the importance of his work. The Society for the Advancement of Management, an American organisation, was originally started as the 'Taylor Society' (Leavitt 1965:1150). Later principles of workplace organisation are often positioned relative to Taylorism, either as a continuation or a departure from it. A large body of Marxist informed literature devotes introductory chapters to examining Tayloristic division of labour as a strategy for capitalist control over production. The sheer amount of literature that refers to Taylor's principles is indicative of its ground-breaking nature.

Rational choice

In everyday language, the word 'rational' has many meanings. In many of its uses, 'rational' is approximately equivalent to 'intelligent' or 'successful'. It can also mean 'sane' referring to the sanity of a decision or an action. By contrast 'irrational' actions are commonly synonymous to senseless or foolish acts.

In theories of Rational Choice, however, the term 'rational' has a very specific meaning referring to the processes of making choices. A rational choice procedure is one that pursues logic of consequence. It anticipates future consequence of possible actions in the present and it seeks to evaluate those consequences and rank them according to their preference. Theories of rational choice make a choice conditional on the answers to four basic questions[25]:

[25] The accounts of theories of decision making in this and the next section are based on March (1994:1-62) and March (1999:13-51).

- The question of alternatives: what actions are possible?

- The question of expectations: What future consequences might follow from each alternative? How likely is each of these future consequences?

- The question of preferences: How valuable are those consequences to the decision maker?

- The question of a decision rule: How is a choice to be made among the alternatives in terms of values of consequences?

This is an extremely powerful theory. The general framework is the basis for many explanations of behaviour. People may explain their own behaviour in terms of the alternatives available to them and the desirability of the consequences of those alternatives. Similarly, people may explain the actions of others by imagining their alternatives, consequences and preferences. Theories of rational choice are epitomised in classical economic theory in which a rational individual with given tastes and preferences trades in a market, seeking to spend resources in such a way as to attain their most preferred basket of goods at the least cost. But 'individuals' can also be aggregated entities. Milton Friedman[26] explicitly compares the decision processes of a firm to those of an individual playing a game, arguing that it is but a short step from the rationality of individual behaviour to the rationality of a firm's decisions. Similarly has a rational actor model been applied to countries bargaining with one another. Theories of rational choice have been used to explain the emergence of public regulation in terms of market failures, multiple person prisoner's dilemma, and the need to curtail opportunistic 'free-rider' behaviour. Indeed, the assumption of rationality is deep-seated in the Western civilisation -- it is rooted in the ideas of the Enlightenment

In one of its more rigorous versions, the theory of rational choice assumes that people have

- full knowledge of the present situation

- a complete set of alternatives for action

- full knowledge about the consequences of those actions

- a consistent preference ordering, that is, consistent values by which alternative consequences of action can be compared in terms of their subjective value

[26] The reference to Friedman and international bargaining is from Weale (1992:38-46)

- a decision rule by which they select a single alternative of action on the basis of its consequences for the preferences

Bounded rationality, a competing set of theories

The earliest challenges to Rational Choice questioned the information assumptions observing that the human mind has serious limitation in terms of attention, memory, comprehension, and computation. Identification of all possible actions is hardly possible, the argument goes, and even less so with determining the future consequences of those actions. Furthermore, an assessment of consequences presumes that future preferences with respect to those consequences are stable, consistent, precise and exogenous. Neither condition is likely to be met.

Theories of limited (or bounded) rationality have therefore evolved, and to a large extent replaced pure theories of rational choice. The core notion is that individuals are *intendedly* rational. Although decision-makers try to be rational, they are constrained by limited cognitive capabilities and incomplete information. Their actions may thus be less than completely rational in spite of their best intentions and efforts. Not all alternatives are known and not all consequences are considered. Instead of having a complete and consistent set of preferences, decision-makers have incomplete and inconsistent goals, which are not all considered at the same time.

Theories of bounded rationality lead to a wholly different class of theories to explain behaviour and decision making. The next two sections will briefly explore four of these, the theory of satisficing, the theory of attention and search, the theory of role following, and the so-called garbage can theory of decision making.

Satisficing, rationing of attention, and roles

The bounded rationality theory of satisficing explains decision making in terms of processes where individuals chose an alternative if it exceeds some criterion or target. By contrast, rational choice theory assumes that individuals maximise, choosing the best alternative, the one with the largest expected return. Under satisficing, an alternative that is better on each preference criterion will not be chosen over one that is good enough on each criterion, if the latter is considered first. Satisficing also makes it possible, that no alternative will satisfy all criteria, in which case no decision will be made.

In the process of buying a new video home appliance, a consumer is not likely to survey the market in its entirety, listing the pros and cons of all alternative models comparing benefits to costs, and choosing the one with the highest benefit-cost ratio. Rather, a search process could be initiated in which alternative products are evaluated from a pre-established set of performance criteria and a maximum price limit. In a pure satisficing context the search stops when the fist video model

that satisfies all criteria and falls within the budget is encountered. A mixture of satisficing and maximising strategies could also be employed in which considerations continue for some more or less predetermined time, rather than strictly until the first satisfactory alternative is found.

In personnel decisions, a maximising procedure would involve finding the best possible combination of persons and tasks. A satisficing procedure would, on the other hand, involve finding a person good enough to do the job. The process of establishing aspirations, of setting targets, of determining what is 'good enough', therefore becomes crucial in a satisficing context of decision making. Satisficing is an attractive notion from a cognitive perspective. Instead of having to worry about an indefinite number of gradations in the environment, individuals simplify the world into two parts -- good enough and not good enough. Satisficing would be attractive to individuals that seek to optimise on the amount of attention and time they are prepared to spend on a given problem.

In theories of bounded rationality, *attention is a scarce resource*. Not all alternatives are know, they must be sought. Not all consequences are known, they must be investigated. Not all preferences are known, they must be evoked. The allocation of attention affects the information that is available, and thus the decision. The core ideas are that information has to be discovered through search and that the key scarce resource is attention. Theories of bounded rationality assume that there are more things to do than there is time to do them; that there are more claims on attention than can be met.

If attention is rationed, decisions can no longer be predicted simply by knowing the features of alternatives and desires. Decisions will be affected by the way decision-makers attend to, or fail to attend to, various alternatives. Interested participants may not be present at a given decision because they are somewhere else. Something may be overlooked because else is being attended to. Decisions happen the way they do because of, more or less haphazard, timing and mobilisation of attention.

Theories of bounded attention analyse and understand decisions in a framework of attention and search. Satisficing is actually less a decision rule than a search rule. It specifies the conditions under which search is triggered or stopped. Search is controlled by a comparison between performance and targets. If performance falls below a target, search is increased. If performance achieves its target, search is decreased. In this context, decision making is understood in a framework of search, and of limited attention. In order to economise on time and attention, individuals will simplify complex situations and use various strategies to cope with excessive information, for instance ignoring some information, and focusing on other. Individuals may ignore interactions and work backward from desired outcomes to

necessary preconditions. In its extreme version, decision making becomes a theory of the first-guess.

Another efficient strategy for an individual who seeks to economise on time and attention is to follow rules of identity. In this framework decision-makers are imagined to ask three questions:

- The question of recognition: What kind of situation am I in?
- The question of identity: What kind of person am I
- The question of rules: What does a person such as I do in a situation like this?

The process is not random, arbitrary or trivial; it is systematic, reasoning, and often quite complicated. The reasoning process thereby becomes one of establishing identities and matching rules to situations. This type of decision logic inverts many of the notions of rational choice. The notions of anticipatory, calculated and consequential action are contrasted to notions of appropriateness, obligation, duty and role.

In support of this position it is argued that people in organisations often follow rules even when it is not obviously in their self-interest to do so. Decisions are shaped by the roles played by decision makers -- family roles, organisational roles, civic roles. Individuals learn what it means to be a student, a teacher, a manager, a parent -- how a doctor acts, how a business owner acts. The decision framework thereby becomes one of role and duty rather than one of anticipatory and consequential choice. The question becomes one of roles and values rather than filling a basket of goods at the least cost.

Garbage can processes

March, Cohen and Olsen have developed an extremely important and highly provocative theory of organisational behaviour, with the infelicitous title of the 'garbage can model'. In this model, organisations are described as contradictory 'organised anarchies', which exhibit three general properties.

First, instead of having clear and consistent objectives the organisation operates on the basis of inconsistent and ill-defined preferences. Different individuals at different levels in the organisation may hold conflicting goals; the same individuals may hold different and incompatible goals at different times; and organisations may not even know their preferences until after decisions have been made.

Second, the organisation's own processes may not be understood by its members; the left hand does not know what the right hand is doing; what happened in the past and why it happened is not clear; and the

connections between the organisation's actions the consequences of its actions are obscure.

Third, there is extremely fluid participation in the decision making process. There are unclear rules for who can participate in the decision; participants come and go; some pay attention, while others do not; key meetings may be dominated by biased, uninformed, and even uninterested individuals.

This mixture is often haphazardly dumped together at 'choice opportunities' -- such as budget conferences or board of directors meetings, referring to the 'garbage can' in the title -- during which the "organisation is expected to produce behaviour that can be called a decision"[27]

In a garbage can process it is assumed that there are exogenous time-dependent arrivals of choice opportunities, of problems, of solutions, and of decision-makers. Problems are attached to solutions, not because of any linkage between means and ends, but because of their temporal proximity. In the extreme, almost any 'solution' can be associated with any 'problem' -- provided that they are evoked at the same time.

These conditions break radically with those that reign under rational choice models, where organisations pursue clear and consistent goals. Rather, 'solutions' are actively looking for problems to attach themselves to, 'problems' are ill-defined and may even by unrecognised, and 'participants' are ill-defined, have limited attention and uncertain intentions. At certain instances, largely determined by exogenous and uncorrelated events, a 'window of opportunity' may open, in which opportunistic actors championing 'solutions' that benefit themselves may be able to convince decision-makers to link their 'solutions' to the problem.

In contrast to the rational choice means-ends perspective on decision-making, the decision-making process becomes characterised by *opportunities for access and attention*. Access in terms of fluid rules for admitting new actors onto the decision-making arena, and attention in terms of getting their point of view onto the agenda, winning the information overload battle.

While March et al. acknowledge that such extreme properties will not be found at all times in all organisations, they insist that the theory explains many of the actions of some organisations, and some of the actions in most organisations. Andersen and Hansen (1991) identified

[27] The garbage can model was presented by March and Olsen (1986) in "Ambiguity and Control" referred to by Andersen and Hansen (1991:23-25); as well as in March, Cohen and Olsen (1988) in "Decisions and Organizations" referred to in Sagan (1993:29-31). I have neither original reference and the account given here is based on Sagan's (1993), Andersen and Hansen's (1991) descriptions and to a lesser extent on March (1996:198-219).

garbage can processes in the political decision to spend DKK 12bn (1.8 percent of the GNP) on an environmental initiative, which was reckoned to have no effect on the stated problem of oxygen depletion phenomena at the sea bed in shallow Danish offshore waters. Much in the same vein, Scott Sagan (1993) presents highly convincing (and truly disturbing) evidence, that the garbage can model explains significant elements of the organisational behaviour of the US nuclear forces' command and control structure during that period of the cold war for which he could gain access to information under various Freedom of Information Acts.

Wicked problems -- a constructionist view

Some 17 years ago Rittel, and Webber (1984) noted that some planning problems are what they termed *wicked problems*, intrinsically ill-defined and with no test of a solution available. I will quote them at length below.

> "As distinguished from problems in the natural sciences, which are definable and separable and may have solutions that are findable, the problems of governmental planning - and especially those of social or policy planning - are ill-defined; and they rely upon elusive political judgement for resolution. (Not 'solution'. Social problems are never solved. At best they are resolved - over and over again.). ...[...]...
>
> The formulation of a wicked problem *is* the problem. The process of formulating the problem and of conceiving a solution (or *re*-solution) are identical, since every specification of the problem is a specification of the direction in which a treatment is considered. Thus, if we recognise deficient mental health services as part of the problem, then - trivially enough - 'improvement of the mental health services' is a specification of solution. If, as the next step, we declare the lack of community centres one deficiency of the mental health services system, then 'procurement of community centres' is the next specification. If it is inadequate treatment within community centres, then improved therapy training of staff may be the locus of solution, and so on. ...[...]...
>
> One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve." (Rittel and Webber 1984:136-138, original emphasis).

The two authors adhere to a constructionist view of human perception, that humans are actively constructing a view of the world based on personal experiences. Or, paraphrasing Schön -- problems do not present themselves as givens. They must be constructed from the materials of problematic situations, which are puzzling, troubling and

uncertain. Problem setting is a process in which, interactively, we *name* the things to which we will attend and *frame* the context in which we will attend to them. But the problem with Technical Rationality is that although problem setting is a necessary condition for technical problem solving, it is not itself a technical problem. Ends are often conflicting and confusing. It is in the process of naming and framing that we may organise and clarify the ends to be achieved and the means to achieve them (Schön 1983:40-41).

This returns the focus to the problem definition step in the LFA, and emphasises its paramount importance. It is also obvious that the stakeholder analysis (LFA step 1) and the subsequent stakeholder participation in the LFA workshop, are the intended means to get around the problem of top-down identification of development problems, which as Mikkelsen (1995:50) notes, is widely accepted as one of the basic causes, why development projects fail. She advocates strongly for participatory approaches, but laments that the LFA all too often is carried out by external people, donor representatives and consultants (ibid:51). There is a danger that the LFA will be used as a ritual, by donor representatives, rather than enhance communication and dialogue, thus becoming a straitjacket [rather than an aid], she notes. (ibid:55).

Discussion

LFA and scientific management

LFA's intellectual debt to Taylorism is evident in at least five respects. First, its overarching concern with issues of increased productivity and improved efficiency of development assistance projects. This is in line with Taylor's preoccupation with the workers' output restriction, or soldiering.

Second, its explicit separation of planning and execution. This separation not only pervades the design-implementation phasing approach but also the staffing policy, which sets exclusion criteria for participation at different phases in the project's life cycle. It is common for Danida, and in particular for Danced, to subcontract discrete parts of the work in the project cycle to external consultants. The tasks of project identification, pre-appraisal, feasibility, design, etc. are therefore often carried out as independent activities, possibly by different consultants due to legal requirements for tendering of public works. Separation is also deliberately built into the tendering procedure for reasons of fair and efficient competition (NAO 1999:clauses 19, 101).

Third, it's hierarchical approach to planning with layers of objectives, outputs and inputs and its concern with managerial control through setting the basis for monitoring and evaluation activities.

Fourth, its cook-book approach, revealing a fundamental (implicit) assumption about "one best way" of achieving a task

Fifth, its preoccupation with quantification of goals; the use of indicators for precise and objective measurements of outputs and as quantitative proxies for abstract development objectives.

More generally it may be argued that LFA is an expression of the scientific management in line with the paradigm of Technical Rationality.

Bounded rationality -- implications for planning

The theories of bounded rationality have at least two major implications for theories of planning. First of all, that it softens the hard core of Rational Choice embodied in the ideal of one-best-way. As March (1999:17) argues, it rather turns "theories of choice into theories of information and attention, that is, into theories of the first guess". In other words, when humans set targets, they look for alternatives that would satisfy those targets, rather than try to find the best imaginable solution. When those targets are satisfied, the search ceases, and attention is diverted to other pressing issues.

Adherents of planning may object that this is precisely what planning intends to improve. However, in a perspective informed by theories of bounded rationality, this would be difficult to surmount -- it might simply be an unattainable ideal. Rasmussen and Jensen (1994:45) note that the dilemma in short (in-a-nutshell) is, that there is a gap between the ideal of rational decision making and the inability in practice of people to decide and behave in a rational way

The second implication follows from the recognition of attention as the key scarce resource. The merits of planning may thus stem from the allocation of time and attention to a specific set of issues, that it entails, rather than the more concrete nature of those tasks and issues.

Heald and Rakusin (1996) advocate precisely this point. They argue that the chief benefits of planning are not derived from the consumption of plans but from engaging in the *process* of planning. In part because it focuses attention, and in part because it entails communication and consensus building. In an extreme version of this theoretical line of reasoning, the *process* becomes more important than the actual *activities* that take place in that process.

Heald and Rakusin (1996) therefore emphasise the 'participative principle' of planning, that it allows various stakeholders to design a future, which they jointly desire. Planning in this sense becomes inseparable from action research, scenario workshops etc. The participative principle raises another important issue: Effective planning cannot be done to or for an organisation -- it must by done by it (ibid:47).

Dismal experiences with strategic business planning

The important critique of planning that is raised above gives rise to quite pessimistic predictions of the benefits of planning. This section will look a little broader, to the business community, in search of empirical evidence that would support such a pessimistic view

In the business literature there is a large body of anecdotal evidence on the failure of (rational choice) strategic planning. The *Fortune* magazine once polled consultants who claimed that less than 10 percent of (rational choice) strategies are successfully implemented. Tom Peters (a management guru) referred to that figure as "wildly inflated" (Kiechel 1984, quoted in Mintzberg 1994:25). Interestingly, it is quite unclear whether strategic planning really pays, despite its enormous popularity in the 1960-1970s. A comprehensive meta-review of evaluation studies found that the overall effect of planning on economic performance ranged from "weak" to "modest" (Mintzberg 1994:97).

A study on the experiences with the French government's comprehensive national planning system noted that "it simply could not predict the economic and social future with any accuracy" and overall that "the Plan was never executed according to Plan" (ibid:116).

Mintzberg also mentions the experiences with the US Planning-Programming-Budgeting-System (PPBS) on several occasions, characterising its as the biggest planning failure ever. McNamara imposed the PPBS on the military establishment in the early 1960s and President Johnson later decreed its use throughout the government. The core idea of PPBS was to tie analysis, planning, strategic decision-making, and budgeting together into a unified structure. Steps were delineated as: formulate objectives, relate program outputs to objectives, relate outputs to inputs (Mintzberg 1994:117-118), and so forth. In an LFA perspective there are two notable points; first a temporal coincidence with the emergence of PPBS and with USAID's development of the Logical Framework (LF), and second, a striking similarity in terminology.

The PPBS experience is generally recognised as a complete failure. A highly respected student of the system observed that: "Nowhere has PPBS (1) been established and (2) influenced governmental decisions (3) according to its own principles. The program structures do not make sense to anyone. They are not, in fact, used to make decisions of any importance". The overall experience with the PPBS was summarised as "PPBS has failed everywhere and at all times." (Wildavsky 1974, quoted in Mintzberg 1994:117,121).

The business literature also offers support to the views of Heald and Rakusin (1996), presented above, that the process of planning is more important than the actual outcomes of this process. Mintzberg (1994:138) finds support of the this point of view in old maxims, such

as 'plans are sometimes useless but the planning process is always indispensable'. One is reminded of the clergy whose sole purpose is to get people inside the door, no matter what happens inside, he notes.

This point of view is so eloquently presented in the quote below, which not only has informative value, but also a considerable amount of amusement value.

> "A good deal of the corporate planning I have observed is like a ritual rain dance; it has no effect on the weather that follows, but those who engage in it think it does. Moreover, it seems to me that much of the advice and instruction related to corporate planning is directed at improving the dancing, not the weather" (Quinn 1980, quoted in Mintzberg 1994:139).

Management by objectives, long out of fashion

The concept of management by objectives (MBO) was conceived by Peter Drucker, a management guru, in the mid 1950s. The concept emphasised rational problem solving methods and focussed on goals, planning, control, appraisal, and accountability. A paper in the mid 1970s observed that the MBO management methodology were found to have a number of potential dysfunctional spin-offs in organisations. The deficiencies included sub-optimal co-ordination of objectives, inflexibility in coping with system dynamics, and a role incompatibility on the part of the superior, both being a coach and judge, thus in most cases worsening the superior-subordinate relationship (French and Hollmann, 1975).

By and large, MBO appears to have gone out of fashion. Modern textbooks on management pay little or no attention to MBO approaches but emphasises system diagnosis and re-diagnosis, system dynamics, empowerment and innovative capabilities. In short, it appears that the emphasis on goal setting has given way for emphasis on how goals are being perceived and reacted upon.

Concluding remarks

What planning does -- and symbolises

Why, then, are development organisations in the 21st century attempting to address complex, and perhaps wicked, problems (1) in a Rational Choice hierarchy of objectives, (2) employing a conventional linear planning approach, (3) with distinct planning and implementation phasing, and (4) employing a planning-by-objectives methodology?

I will again quote Wildavsky who captures issues of a broader political perspective quite precisely in:

> "Planning is not really defended for what it does but for *what it symbolizes*. Planning, identified with reason, is conceived to be the way in which intelligence is applied to social problems. The efforts of planners are presumably better than other people's because they result in policy proposals that are systematic, efficient, coordinated, consistent and rational. It is words like these that convey the superiority of planning. The virtue of planning is that it embodies universal norms of *rational choice*." (Wildavsky 1973, quoted in Mintzberg 1994:18-19, emphasis added)

This view, or more precisely: this hypothesis, so eloquently phrased by Wildavsky, will be pursued in the first case study on the fish CP project. This case study will offer a glimpse into the political context in which Danced operate, with rivals and foes, drawing on material in a recent evaluation of Danish development assistance carried out by the Danish National Accounting Office (NAO 1999). It will be argued that planning according to LFA guidelines is not only conducted for the face-value objective of improving efficiency, but also that planning may serve as instruments to legitimise organisational decisions, acting as means to shield the organisation from blame from its rivals or foes.

Two competing sets of theories

One the one hand, we have a set of theories which argue for the merits of planning and give rise to quite optimistic predictions that increased levels of planning will lead to better and more efficient projects. We can label them Rational Choice or Technical Rationality -- their epistemology is that of positivism.

On the other hand, we have a set of alternative and competing theories that offer a quite different perspective on the merits of planning. The theory of bounded rationality, in its more benign form, argues that limitations in the information processing capabilities of humans in effect short-circuit the planning process. The theory argues that a planning exercise is better explained from a perspective of attention

and search, than from an inventory of existing problems and available solutions.

In its more malign forms, it leads to the caricature view of a decision-making process as a 'garbage can' process, where solutions are actively looking for problems to attach themselves to, and where (in rational theories, irrelevant) issues of timing, access to decision-makers, attention, and the occurrence of exogenous freak events that make competing claims on attention, are decisive for the outcome of the planning process. In its extreme version, the process of planning becomes more important than the outcome of the planning. This leads to the view that the chief benefits of planning are not derived from the *consumption* of plans but from engaging in the *process* of planning -- caveat, consumers of plans! Additionally, other authors argue from a constructionist perspective, that people problems simply escape rigorous planning, they are 'wicked problems', intrinsically ill-defined and with no test of a solution available. Naming and framing processes are at play -- different individuals will inevitably produce different plans no matter the efforts to structure and standardise. Their epistemology is largely that of post-modernism.

Which of the two sets of theories should we trust? In my opinion none, and both. Theories on rational planning are tempting with their ability to present highly complex situations in a neat and orderly manner[28], highlighting logical linkages, providing guidance for action. However, the competing theories alert us that this view is far too simplistic -- rational planning concerns ideal situations that do not exist in practice, they are utopian.

This theme of rationality versus bounded rationality will be taken up again in later chapters that present the empirical work of this study. The theories outlined in this chapter will find use there, to offer competing explanations for observed decisions and behaviours.

The catch 22 of criticising planning

This chapter started with a presentation of the mechanics of the LFA planning tool and has thereafter provided ample room for theories that question and generally decry the merits of planning.

However, a pejorative presentation of planning that highlights its intrinsic deficiencies and other weaknesses may easily act as a boomerang that turns around and haunts the basic proposition of this study. There is a catch 22 of criticising planning. I am acutely cognisant, that a critique of the intrinsic inadequacies of planning methodologies is incompatible with the basic purpose of this study, which is to improve the quality of cleaner production projects through -- precisely, better planning! A too stark critique will defeat the study's own ends.

[28] Note that this is *conceptual* simplicity only, merely rendering the world simple enough to comprehend.

The critique of planning provides new perspectives and illuminating insights to differences between our conceptions of reality, as these conceptions are presented in written documentation and plans, and the real world 'out there'.

It is noteworthy, however, that the critique is important mostly for the insights it offers. It offers preciously little guidance on what else to do. With this general caveat in mind, this study will use the two sets of competing theories as alternative sources of illumination when interpreting and discussing the empirical observations.

Chapter 5.
The South African context

Introduction

This study accepts the point of view, that occupational health and safety cannot be seen in isolation from other and more general workplace conditions and the manner in which work is organised. These, in turn, cannot be seen in isolation from the conditions that prevail in the general society, the people, the political factions, the general standard of living, etc.

The empirical observations concerning workers, working conditions, perceptions of business owners, the organisation of OHS work, etc., will therefore have to be viewed in a broader perspective than just that of the workplace. It is the purpose of this chapter to provide the reader with that perspective and prepare the ground for the interpretation of the observation from the case studies, in particular those observations which involve owners of small businesses.

The setting up till the mid-1980s

Wealth and inequality

The mineral resources of South Africa are truly outstanding. South Africa contains major proportions of known world reserves in respect of manganese (82%), platinum (69%), chrome (56%), gold (44%), aluminium silicates (37%), and vanadium (33%). Indeed, this richness is best captured in listing, not the resources that are, but those that are absent, of which the most significant are petroleum and bauxite (Tarp 1993).

South Africa also has a large and diverse manufacturing base and its economy is truly a regional giant. The South African gross domestic product (GDP) makes up 30 percent of that of the entire African continent, all 53 countries combined[29].

The distribution of this wealth amongst South Africans is highly unequal. The Gini coefficient, a measure of income inequality, is

[29] Source: Computed from World Bank 2000, table 2-1, 1997 figures

among the highest in the world, superseded only by that of Gabon, and closely followed by those of Malawi, Honduras, Brazil and Sierra Leone[30]. Income inequality is closely linked to rural poverty and above all to racial inequality. The United Nations Development Programme (UNDP) regularly releases a so-called Human Development Index (HDI). A report observed, that if racially disaggregated, the HDI puts the black population on a par with the Congo while whites score on a level with Canada (Standing et al. 1996:20).

It was the discovery of diamonds in 1867 in what became Kimberley and of large deposits of gold in 1886 in what became Johannesburg that transformed South Africa from an agriculturally based to an industrial economy. Johannesburg is literally built on top of gold deposits, which is still evidenced by place names in Johannesburg Central such as Main Reef Road and City Deep. Today, Johannesburg is the provincial capital of Gauteng Province. That province is the economic powerhouse of the country, claiming less than 2 percent of the country's area but contributing with about 40 percent of its gross national product.

Racial discriminatory practices of the past -- containment of urbanisation amongst Africans

The Republic of South Africa gained independence from the British in 1910 and its first constitution gave the white minority an almost complete control of political authority. The 1913 Land Act created reserves for the blacks[31] with the intention to consolidate white possessions of land outside the reserves, and to destroy the independence of African peasant workers. Africans were denied the right to buy land in white areas, from which they were also evicted on a large scale. The dispossession of land and a 'hut tax' that forced men to work for a wage to pay their taxes meant that large numbers of African workers were forced onto the cheap labour market. The Natives (Urban Areas) Act of 1923 deprived Africans of rights to live in towns unless their services were required by whites.

These and other Acts passed in the 1950s and 1960s founded an economy, which was extensively based on migrant labour. Except for African labourers needed by whites, blacks were relegated to 'Bantu Homelands'. As a result, millions of blacks were forced to relocate to desolate areas with poor infrastructure, rudimentary public services

[30] Source: World Bank (2001) based on a 1996 data set provided by Deininger and Squire. Only data that qualified to enter the 'high quality' data set have been considered. The ranking involves the latest Gini coefficients but from different years: Gabon 63.18 (1977), South Africa 62.30 (1993), Malawi 62.00 (1993), Honduras 61.88 (1968), Brazil 61.76 (1985) and Sierra Leone 60.79 (1968).

[31] There are other major ethic groups in South Africa. For instance, there is a large Indian community in Durban. For simplicity, this thesis will only refer to blacks and whites, essentially meaning historically disadvantaged and historically favoured population groups.

such as health care services and education, and far from employment opportunities.

While urbanisation in other industrialising societies was a transitional phenomenon in the shift from an agrarian to an urban-industrial society, the Bantu Homelands system entrenched migrant labour, with extensive movement between rural and urban areas, at the centre of the economic system. The rural Homelands were populated with women and children, while the men lived around urban or industrial areas where employment could be found, seriously disrupting family and social patterns[32].

Early apartheid policies were essentially concerned with containing the process of urbanisation amongst Africans. While the unworkable nature of this approach was soon evident, it was highly durable. Jan Smuts, twice South Africa's Prime Minister, observed already in 1942 that "You might as well try to sweep the ocean back with a broom" (quoted in Lemon 1991:6). Yet, kind of a reform was only initiated by P.W. Botha in the 1980s, after which shanty towns and squatter communities began to proliferate in metropolitan areas.

Africans with jobs in white areas had to reside outside town, in the so-called Townships, thereby also distorting residential patterns. The Stallard commission of 1922 condensed the official attitude to African labourers in the dictum that "the natives should only be allowed to enter the urban areas, which are essentially the White mans creation, when he is willing to enter and minister to the needs of the White man, and should depart therefrom when he ceases so to minister" (Transvaal 1922, para 42; quoted in Lemon 1991:4). Africans coming to town were allowed 14 days to find work (reduced to 3 days in 1945) (ibid:5).

Urban areas were in this manner highly segregated along racial lines. This segregation comprised all population groups. White areas were usually near the city centre followed by coloured and Indian group areas, and finally an African area. The spatial segregation was intended to last, hence racial zoning in urban areas allowed space for future growth of the areas. Urban sprawl and long commuting hours evolved as a consequence of racial segregation.

For sheer economic survival, many rural households simply had to find access to employment in urban economies. They found various means of doing so, ranging from backyard shacks in formal townships to squatter camps within a less burdensome commuting distance from work. By the end of the 1980s, there was an estimated 7 million informal settlers in and around the urban areas (Lemon 1991:20), that is roughly 20 percent of the population (SA Yearbook 1998)

[32] This account is largely based on Webster (1997) and Tarp (1993)

Apartheid accentuated racial and ethnic conflicts

The apartheid policies have created fertile grounds for conflict and hostilities. Authors point to the irony that the human damage inflicted by race zoning 'unquestionably' has accentuated and even initiated the racial antipathy it was intended to prevent. Many African communities were emotionally impoverished by the destruction of their community and their remoteness from the area in which they had grown up (Lemon 1991:10). Moreover, many informal settlements fell in violent conflict with each other, in part due to unequal access to basic urban necessities, in part due to ethnic rivalry. Thus, very poor shanty-town resident have attacked the still poor, but relatively better off, township residents. In a similar vein have the hostel dwellers, the poorest and socially most marginalised of the black urban communities, been in conflict with the shanty and township residents.

The system also accentuated ethnic conflicts. There is some evidence that Xhosa speakers from the Transkei region tended to be less attached to the land than Zulu speakers from the KwaZulu (Natal) region, who had stronger links to subsistence agriculture and traditional social structures in their home towns. Xhosa speakers would thus move into shantytowns or squatter camps to set up an urban family while Zulu speakers tended to populate the male-dominated hostels, which became "increasingly ethnically introverted, organisationally isolated, and socio-economically marginalised" (Morris and Hindson, 1992:48).

Explosive conflicts at the workplace could arise between permanent township residents with families and migrant workers living in hostels -- two groups with different material needs. Most Xhosa speaking people would support the African National Congress, ANC and be organised in ANC dominated unions, to which shorter working hours, for example, would be attractive. Zulu speakers would on the other hand support the Inkatha Freedom Party, IFP, and organise themselves in an IFP led union. Recreational time with family is not a possibility for a migrant worker who is instead keen to maximise his working time and hence his earnings. Harvey (1996:30) identifies such differences of material interests and inter-union rivalry as the reason behind a massacre outside a Johannesburg factory in 1996[33].

Early industrial relations system

The early division between white and black in the workplace has created two distinct labour markets. The first, primary, labour market consisted of English speaking white workers who had access to skills, education and political power. Later they were joined by Afrikaner (white Afrikaans speaking) workers who initially had few skills to offer and struggled to compete with expatriate artisans from Britain.

[33], Eight men were killed and more than 20 injured when a group armed with AK-47 assault rifles and 9mm pistols opened fire at a crowd outside the factory gates (MG 19960202)

Early unionism in the mining sector was thus characterised by the conflict of Afrikaners who found themselves between three hostile forces -- British mine owners, black labour, and an unsympathetic government. This conflict culminated in a bloody 1922 strike in which army and airforce intervention killed 153 miners and wounded 500. Five thousand were arrested and four leaders hanged for treason. After this strike, however, the government committed to practice a form of 'affirmative action' for white workers, particularly Afrikaner workers, through the creation of job opportunities in parastatal establishments, such as the railways (Webster 1997:19).

The second, secondary, labour market consisted of black workers who were denied access to education and political power. The Industrial Conciliation Act of 1924 – later renamed the Labour Relations Act (LRA) – entrenched this division, providing trade union rights for non-African workers and denying such rights to African workers. So-called 'pass-bearing natives' were simply excluded from the definition of an employee. Black workers were subjected to a Master and Servants Act, which criminalised those who broke their contracts. And the Bantu Education Act of 1955, which placed African education under the Native Affairs Department, led to deliberate inferior education of blacks sufficient only for 'certain forms of labour' (Tarp 1993:11, Webster 1997:22), for example by curtailing the curricula taught in black schools.

The white unions, particularly those of the parastatals (railways and steel), were virtually co-opted by the state. They achieved gains for their members through their political access to the state. Members did not participate in most decision making, and strikes became increasingly unheard of.

Commissions of inquiry into the industrial relations system

Mass strikes in Durban in early 1973 by an estimated 100.000 workers were an unprecedented expression of African worker dissatisfaction and capacity to organise and marked the beginning of a period with increased levels of industrial action. As a result, several commissions were set up over the following span of years (Webster 1997:23; Zwi et al. 1988:693) of which the Erasmus and the Wiehahn Commission will be detailed below.

The Erasmus Commission was established in 1974 to undertake an enquiry into the state of occupational *health* in South Africa, thereby opting for a narrow interpretation of health, excluding accidents. The Commission's report in 1976 painted a dismal picture; it was critical of statutory protection of health at work, which was found to be fragmented, incomplete and out of date. The Commission recommended that legislation be promulgated before occupational health and safety became a source of conflict in the workplace (Zwi et al. 1988:693).

Management "should be obliged to consult workers or their representatives on industrial health problems and working conditions and to grant them a hearing when they have complaints" (quoted in Macun 1989:54). This approach reflected recent international trends on deregulation and employee participation, for example as espoused in the influential 1972 UK Robens Report. However, the Erasmus Commission interpreted employee participation narrowly as consultation, not co-operation. It also rejected the possibility of unions appointing representative who would have the right to inspect a workplace. The Commission argued that South Africa's trade union history was not as old as that of Britain; that races in South Africa had different norms and would not always agree on demands; and that many miners were foreigners, who might "become the biggest pressure groups with the most unreasonable demands and as aliens they may even seek to dictate labour policy in this country" (op. cit.:54).

Many of the recommendation of the Erasmus Commission were quite radical, for example that a single national occupational health Act should be promulgated, which should fall under the auspices of the Department of Health (DOH)– thus bypassing the Department of Labour (DOL), the customary authority on workplace occupational health and safety – and that all factory inspectors should be transferred to the DOH (Wiehahn 1980:37). Consequently, only a few minor recommendations were accepted and implemented in subsequent legislation, and a new commission was appointed only one year later.

The emergence of black unions

The Wiehahn Commission was set up in 1977 to review the industrial relations system with particular regard to review the resolution of labour disputes. But included in its terms of reference was also a review of the protection of the safety and health of workers in South Africa. The Wiehahn commission believed that conflict could be removed from the shop floor and institutionalised in the existing industrial relations system. Therefore, the Labour Relations Act was amended to allow for the recognition of black unions for the first time in South African industrial relations history.

The intention was to draw the emerging black unions into the existing Industrial Councils structure, thus pre-empting attempts by these unions to establish a presence at the shop floor (Webster 1997:23). In response to the prospect of legal black unions "employers rushed to form [management - shop floor] liaison committees" (Macun 1989:55). The purpose was clearly to establish a channel of communication between management and the shop floor, controlled by management, through which grievances and disputes could be handled, in order to pre-empt and possibly prevent unionisation; and if unions gained foothold, that the union should not gain control over grievance and dispute handling.

The Wiehahn Commission also observed that a worker's "safety at work now features as an important component of a company's industrial relations" (quoted in Zwi et al. 1988:697). Following the Wiehahn Commission's recommendations, new occupational health and safety legislation was enacted in 1983, to take effect in 1984. This Machinery and Occupational Safety Act (MOSA) provided for a system of factory safety committees consisting of representatives of both management and workers, which would meet regularly.

However, the Act was ambiguous with respect to the appointment of safety representatives: employers were to "designate in writing one or more safety representatives" (quoted in Macun 1989:64). In practice, this gave management the dominant role in establishing a safety committee and in deciding its composition, not the employees, let alone the unions. MOSA was in many ways an attempt to avoid industrial conflict over workplace health and safety by granting employees an, at best, advisory role, rather than a decision making role. This system was in place for close to ten years until a new occupational health and safety Act, enacted in 1993, provided for the *election* of safety representative amongst the employees and also set up various arbitration procedures in case of controversies (OHS Act No. 85, 1993, section 17).

Unionism a part of wider struggle for liberation

After Wiehahn, the membership of the newly legalised black unions grew dramatically, and with this their political power. Several federations of unions were formed of which the Congress of South African Trade Unions (COSATU), formed in 1985, is the most significant, having more members than all the other federations put together. The formation of COSATU in 1985 also marked a shift where unions with their newly won power overtly confronted the apartheid regime, taking on national policy issues of democracy and equality, and voicing the aspirations for political representation of Africans. Cyril Ramaphosa, then general secretary of the National Union of Mineworkers, opened COSATU's inaugural congress, stating that:

> "We all agree that *the struggle of workers on the shop-floor cannot be separated from the wider struggle for liberation* ... Our most urgent task is to develop unity among workers. We would wish COSATU to give firm political direction" (Ramaphosa quoted in Webster 1997:24, emphasis added)

Ramaphosa's statement clearly linked black unions newly established industrial powers with a wider struggle for African political power. It also worked the other way around, taking the struggle for freedom to the workplace, beginning a period of union militancy.½

Workplace relations under apartheid

A general view of blacks as servants to whites

Holdt (1995) provides a gloomy picture of workplace relations under apartheid. All managers and foremen were white; and they managed black workers in the same way as whites in general related to black people: as servants with no rights of citizenship. White foremen and managers could dismiss black workers at will, without following any procedure. They hit and swore at black workers. Black workers were expected to buy cigarettes for whites, or wash their cars during working hours. There were no clear lines of authority; any white foreman could issue an order to a black. If he refused a second foreman's orders to start a different task, he could be disciplined for 'refusing to carry out instructions' (Holdt 1995:5).

The general view of blacks as servants to whites is witnessed in the following practical guideline to the mine safety practitioner on general rules and regulations, in which black workers are viewed as commodity comparable with e.g. company tools:

(i) All accidents, including minor ones, must be reported before the end of the shift

(ii) First aid must be obtained immediately for any injury sustained, however minor

(iii) Private work may not be carried out on the mine without the manager's permission

(iv) Mine labour may not be used *for private purposes* without the manager's permission

(v) Alterations may not be made to company houses (including painting) without the manager's permission" (Anon. 1982:22, emphasis added)

There was also a widespread belief that certain ethnic groups were better at some jobs than others. Top executives from the mining industry, who gave evidence before the Myburgh Commission into mine violence in the mid 1990s, believed in genetic skills. An executive director said, "It is well accepted in the industry that persons from Lesotho are skilled in shaft sinking activities". A general mine manager told the commission that Zulus make good drillers and Shangaans are good mechanics. However, Afrikaners are good at a number of jobs (Paton 1996:49).

A manager of a car manufacturer gave the following account of workplace relations during the 1970s: "In the 1970s the workers were very docile. They would do whatever you told them to do, but they didn't bring their brain to it, there was no participation. It was a baas-boy relationship [baas means boss in Afrikaans]. I remember when we used to have a workers council, before the union came, and prior to that there was nothing: production foremen had the full authority to

hire and fire people. It was exactly as you hired and fired a garden boy" (Barchiesi 1997:84). .

Company documents revealed stories like this: "F. Mashabane, [..(company id..] 1979: was having epilepsy and asked foreman to go and see African doctor (herbalist) and foreman agreed, but on going back to work he was terminated on arrival" (ibid.)

A white staff officer at a South African car manufacturer gave me the following account:

> "... historically, all the foremen where white, usually Afrikaans, and the operating level were black. So you had a situation: I'm the white, I'm the boss, I say, you do. Very little interaction between the two. If you think of some of the old foremen we used to have -- they used to wear heavy boots and khaki -- Do you remember those old days? [the white staff officer turns to the black shopsteward who nods and says something inaudible] -- -- and carry a big stick -- and if I said, and you didn't do, you got a clonk"[34]

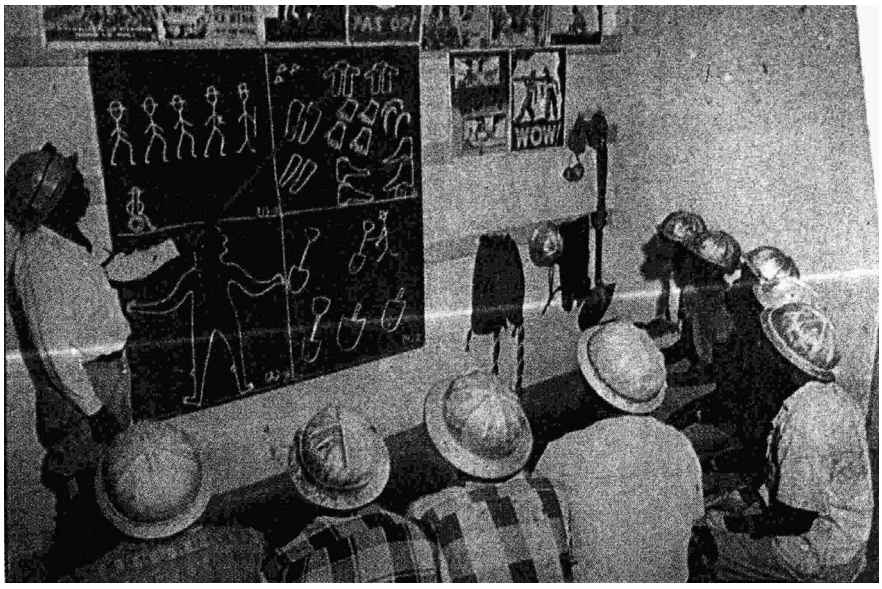

Figure 8 Training black mine workers basic working skills in the early 1980s

Many mine workers were migrant workers from remote rural areas having little experience with formal employment and industrial work organisation.

Source: On the front page of Loss Control Survey, a Chamber of Mines publication, November issue, 1982: 1(2). White stripe from copy facility at the State Library in Pretoria

[34] Own interview with Allan Nichols, training consultant, and Andrew Msimango, shopsteward and NUMSA representative at Samcor, a South African car manufacturer, Oct 26, 1998

Taking the war of resistance to the shop floor -- ungovernability of the workplace

While Ramaphosa's statement above linked the unions' newly established shop floor presence to a wider struggle for African political power, it also worked the other way around, taking the struggle for freedom to the workplace at an unprecedented scale. This began, in the terms of Karl von Holdt from the sociology of work unit at the University of the Witwatersrand, a period of union militancy and of shop floor 'ungovernability'. He explored this phenomenon in several factory studies where he identified a pattern of frequent stoppages, ignoring of agreed procedures, and a culture of informal resistance to white authority. Violence in the workplace, especially the intimidation and killings of scabs, became a feature of strikes (Webster 1997:24).

In a detailed study of Highveld Steel, a large steel company, Holdt (1995) gives a vivid description of the emergence of union militancy. After the union came to the plant in the early 1980s shopstewards first began to contest management's disciplinary powers and decisions. The shopstewards noted that: "It would be highly unimaginable from the workers to see a shopsteward fighting to defend another worker by fighting management, who was a white person that nobody would dare to challenge at the time". "Once some cases had been won, gradually people started to see their Messiah having now arrived on the workplace" (ibid.:6).

In 1988, the company brought a legal case against the union for unfair labour practices. In the documentation of the case, the company complained that more than 4,000 workers had engaged in an 11 hours stay-away, demanding that four former employees be reinstated, who had been dismissed for participating in an earlier stay-away. The company also alleged that when two white employees approached a mob to investigate reports of assaults on scabs, there were shouts that they should be grabbed: they retreated "fearing for their lives".

An angry mob danced around while exhibiting a red flag. Workers "armed with sticks and iron bars" entered the administration building and "forcefully removed black staff members from their places of work", coercing them to join a spontaneous strike. Then "a large group of strikers" armed with sjamboks (a sjambok is a whip) forced their way to the security gates, "rounded up all those at work and marched them to the Steel works" (company documents quoted in Holdt 1995:8,13).

A shopsteward recalled:

> "The culture of resistance meant that at that time we were faced with the system of apartheid which was working hand-in-hand with the capitalist system, and naturally as the union we had to resist. One way of resisting was through the industrial action: the strikes, the stayaways, the go-slows, the overtime bans. At that time we were never concerned about economy. In fact, we

> wanted to see this economy suffering because it had no significance for us other than keeping the very system of apartheid alive" (shopsteward quoted in Holdt 1995:14).

Sabotage of production equipment took place. While automation of plant layout reduced the direct need for manpower it also could increase plant vulnerability. At a newly automated line in an automobile plant outside Pretoria in 1985 frequent breakdowns of the installed robot and conveyor systems were reported. A manager complained that the systems just introduced "made it easy for employees to damage parts"(Barchiesi 1997:87-88).

Factories under worker control

Holdt also undertook an in-depth study on a 1990 strike at Mercedes Benz South Africa (MBSA) in which a trivial wage dispute between the workers and the company, flamed tensions between two rivalling factions within the union. In the intra-union power struggle that followed, the conflict escalated out of control and about two thousand workers "flouted all agreements and »ran amok« in the plant" (Holdt 1990:43).

Köpke, the MBSA chairman, contended that the entire factory had been under worker control since 1987. "Supervisors used to clock in and then lock themselves in their offices for the whole day. They didn't dare go out on the assembly lines" (chairman Köpke quoted in Holdt 1990:38). At times some workers even stood at the assembly lines with mock AK-47s or bazookas strapped to their backs. This was a symbol of defiance and rejection of the company, which many workers believed was merely an extension of the repressive apartheid structures.

Production was severely affected, the chairman said: "Since 1987 we have never achieved our weekly production targets. Five years ago the Honda plant built 70 Hondas a day. In August 1988 workers said they were working too hard, and since we've only built 40 a day". After a dispute, which closed the plant for 10 days, the company said that workers could get back-pay if they made up lost production. "By 3pm we hit 70 cars a day. The same workers with the same tools did it with ease. That's what I call worker control. These are the most capable workers in the world. If you can steer that energy in the right direction this would be a land of milk and honey" (chairman Köpke quoted in Holdt 1990:39).

To honour the political leader Nelson Mandela, who had recently been released from 27 years of imprisonment, the workers built him a Mercedes car that "... came off the line with nine faults. In this company cars don't come off the line with less than 68 faults. In Germany, about 13 faults. Normally it takes 14 days to build that car – Mandela's car was built in four days. Only 9 faults!", the chairman said (ibid.).

OHS and the apartheid state

Trade unions saw occupational health and safety issues as an integral part of apartheid as captured in a quote by Paul Benjamin, a union lawyer: "What ... the system really meant was when workers got sick or injured they got sent back to the homelands with little or no money, and somebody was hired in their place. Nothing was done to prevent similar accidents happening again. The system meant that accidents were cheap for bosses and expensive for workers" (Benjamin in Magane et al. 1997:181). In fact, Benjamin argued at a COSATU (union) conference in 1995 that "the health and safety legislation is one of the last bastions of apartheid" (ibid:189)

Miller, a union health and safety officer, has given a lucid account of the problems that unions faced under the apartheid regime. In a 1993 paper, she observed that workers and unions were denied basic democratic rights such as right-to-know about exposures to hazardous chemical substances used in the production. The right-to-know, she said, must comprise information on the actual chemical compounds and not just trade names. It must comprise knowledge of hazards and symptoms, disclosure of hygiene measurements, and workers' access to their own medical records. But, "obtaining such information is often like dragging blood from a stone. South Africa is a very secret society and this is mirrored at the workplace". "Some bosses suggest that if workers know what the symptoms are, malingering will increase" (Miller 1993:96-97).

Workers had no access to information held by state bodies. "For example, Cape Gas is a particularly old, dirty and problematic factory. The company refuses us access but says it is inspected under the [MOSA] Act. The inspectorate claims that conditions are satisfactory, but refuses to give us access to their reports." (ibid.)

The starkest evidence is probably found in the mining sector, in which very high accident rates prevailed. Leger (1992:89) noted that "at current accident levels, a black underground miner who spends twenty years underground faces a one in thirty chance of being killed and a risk of nearly one in two[35] of being permanently disabled". The risk increased with mining depth; in deep[36] mines "one out of eleven miners working for twenty years [...] is likely to be killed in an accident" (ibid.).

The official indifference to this state of affairs is captured in the official accident statistics of the Department of Mines and Energy Affairs (DMEA). A monstrous 98.33 percent of all accidents in 1983

[35] The permanent disablement figure is probably grossly underestimated due to systematic under-reporting of occupational diseases of migrant workers (White 1997:22)

[36] The South African mining industry is internationally renowned for pioneering technology to mine at great depths. By convention (Leger 1992:78), 'shallow' mines involve mining less than 1,000 m deep, 'intermediate' depth is defined as between 1,000 and 2,250 m, and 'deep' mining is below 2,250 m.

were caused by "Danger inherent to work or misadventure", i.e. causes supposedly beyond human control and to which mitigating action would likely be futile. In stark contrast, for example, only 0.05 percent of the accidents were caused by "Fault of management", and 0.42 percent as "Fault of others" (DMEA statistics quoted in Eisner and Leger 1988b:6).

With occupational health and safety so intricately connected with racial discrimination and repression it became inseparable from industrial conflict, simply seen as part of a wide struggle for liberation. Unsurprisingly, occupational health and safety found use as a union organising tool. In a campaign to have the byssinosis ('brown-lung') condition amongst textile workers recognised as a compensable occupational disease, workers were organised at the same time of carrying out medical tests (Magane et al. 1997:180). Also, in the mining sector, Ramaphosa stated that occupational health and safety was an important organising tool (Zwi et al. 1988:700).

The post-apartheid era

Easing tensions in the post-apartheid labour market

The first all-inclusive democratic elections in 1994 led to the formation of a government led by the African National Congress (ANC) political party. The situation with labour unrest, socio-economic conflict and political violence was for obvious reasons unsustainable and the government launched a number of initiates to enhance social dialogue and provide mechanisms for problem solving and conflict resolution.

Of great importance to stabilising the industrial relations system has been the establishment of an independent institution, now the Commission for Conciliation, Mediation and Arbitration (CCMA), to provide a formal mechanism to resolve labour disputes. The institution offers a dispute settlement process based on conciliation and arbitration. The idea is to reach consensus through negotiation, backed by legal action.

The government also set up a three pronged effort to enhance dialogue and facilitate conflict resolution between organised labour and organised business. At the macro level it established the National Economic Development and Labour Council (Nedlac) as a "representative and consensus-seeking body where the parties ... will seek to reach agreement through negotiation and discussion based on proper mandates" (Nedlac 2000). Nedlac is an expanded tri-partite body for general discussion on social and economic policy, i.e. a clear attempt to pursue social corporatism (Michie 1997:162). The parties represented are organised labour, government, organised business and, interestingly, the community, represented by organisations for women, youth, rural, disabled and civic sectors.

At the intermediate sector level, the government established so-called National Bargaining Forums (NBFs) as vehicles that attempt to lift the highly conflictual issues of wage bargaining away from the workplace up to a more detached meso-level. Finally, various initiatives have been launched to enhance dialogue at the company level through workplace forums and joint liaison committees.

The government also passed major pieces of new labour legislation to enhance the formal rights of workers, most notably the Labour Relations Act (LRA 1995) and the Basic Conditions of Employment Act (BCEA 1997).

By and large, these initiatives appear to have had the intended effect, easing the level of workplace tension. Macro-indicators of industrial action, such as strike statistics based on levels of workdays lost, declined sharply in the first post-apartheid years 1995-1997 while the years 1998 and 1999 saw marked upsurges, however not reaching pre-1994 levels. The overall downward trend has continued and workdays lost reached a ten-year low in 2000 (Baskin 1998, Levy 2000, MG 20010117).

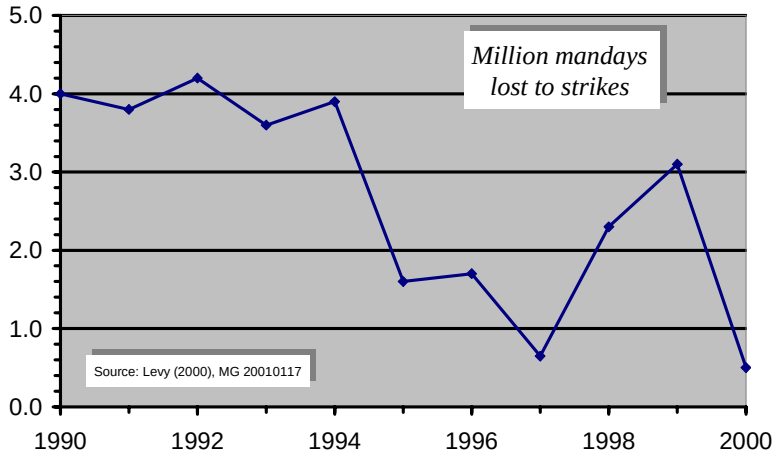

Figure 9 Million man-days lost to strikes 1990-2000

Source: Levy (2000), MG 20010117

Analysis of the first upsurge in strike action in 1998 revealed that most of the strikes were concerned with wage issues suggesting that other rights-based issues - such as grievances, dismissals or retrenchments - indeed were being solved at the CCMA and elsewhere (Baskin and Grawitsky 1998:7). There was little evidence of the 1998 strikes being political, they were almost entirely caused by economic factors, in part because global and competitive pressures constrained employers form offering significant real wage increases. A further key feature was that most strikes were procedural following the provisions laid out in the new LRA (Baskin 1998:21, 28).

Although on a declining scale, violence continues to be a feature of workplace conflict. In 1997 about 3,000 construction workers went on the rampage in the Saldanha Steel site burning cars and offices, looting and damaging the new plant. The cost implications of the riot were about R 50m. The causes behind this conflict deserve mention as they were related to the 'independent contractor' exclusion clauses in the newly passed labour legislation[37]. This exclusion clause and its relation to macro changes in the employment structure are dealt with in more detail a few sections down.

Key 1998 strikes were also marred by high levels of violence, conflict and damage to property. An estimated eleven people lost their lives, there were numerous injuries, shootings outside companies, and in one incident a mob destroyed a company conference centre. Much of the aggression was directed at replacement labour (scabs), which firms are allowed to take in accordance with provisions in the new LRA. But a contributory factor was also "the culture of violence or the tolerance of violence which still exists in South Africa" (Baskin 1998:23). Militancy and determination to act among much of the union's middle management layers, and 'delivery pressures' facing many union leaders were also contributing factors (ibid:21).

Furthermore, in the year 2000 a conflict at Volkswagen South Africa between two rivalling unions was apparently close to run out of control. Eventually the conflict was resolved peacefully, but the minister of labour at a certain stage was prompted to warn that the atmosphere was "highly charged" and that the dispute "could explode into violence in the local community and disrupt industry in the Eastern Cape" (BR 20000329).

A neo-liberal stance on macro economics

These 'delivery pressures' facing unions, as noted above, must be seen in the context of the government's political and economic policy. During the years of apartheid, when the ANC was in opposition, it was blatantly communist. However, when it came into government in 1994 it took a clear neo-liberal stance on economic policy pursuing such goals as macro-economic stability, containment of inflation, redistribution through economic growth, liberalisation of the trade regime, lowering import customs, and a drive to stimulate exports.

The policy shift is lucidly illustrated through the shift from ANC's 1990 demands for nationalisation of mines, banks and monopoly industries, to open support by President Mandela (ANC) for privatisation on his 1996 trip to Germany to encourage foreign investments (Webster 1997:12, Bell 19990212).

[37] An account of the grievances leading to the riot is given in Numsa News (1) 1998. The government acknowledge that some employers seek to circumvent the new LRA labour legislation using the independent contractor loophole, and that this is "unstable", see DOL 1999:32. The costs in ' Saldanha is ready to roll after rehearsals' (BT 19980628).

This macro economic policy is embodied in the government's so-called Growth, Employment and Redistribution (GEAR) doctrine, which closely follows policy recommendations laid out by the IMF and the World Bank. The GEAR policy is incompatible with traditional Keynesian macro economic policy, that economic growth can be attained through public spending -- an alternative policy preferred by the union movement to advance the process of redistribution of wealth.

After the ANC-led government took seat in 1994, the ANC sought to maintain its close relationship with the trade union movement by entering into a so-called tri-partite alliance with the largest trade union federation, COSATU, and the South African Communist Party (SACP), the so-called alliance of social partners. However, serious cracks were developing within this alliance over differences of opinion on economic policy with unions overtly opposing GEAR[38].

That the government is determined and committed to GEAR can be illustrated by the fact that the State Tender Board awarded an order for 20,000 defence force garments to China. The bid from the domestic textile industry, which is in serious crisis due to import tariff reductions, was not competitive. The decision gave rise to loud union discontent. In particular, as the garment order was awarded just prior to a large-scale union campaign comprising a general strike and a march in Johannesburg against job losses[39].

Hence the growing frustrations and 'pressures for delivery' within the union movement, which Baskin (1998) identified as contributing factors behind militancy and the 1998 surge in strike action.

[38] 'There is an alternative to GEAR, and the unions wrote it' (Bell 19990528). 'Tripartite tensions may come to a head' (Bell 20000114). 'Demonstrations merely reflect subterranean rumblings' (Bell 2000519). Various aspects of the tensions are also discussed in 'Fight against water privatisation has finally dried up' (Bell 19990507), Time to swap sophistry for tough talk' (Bell 19990521), 'It's pay-back time, say unions after landslide victory' (Bell 19990709), and ' South Africa`s giant step to international norms' (Bell 20000211).

[39] Textile unions call for inquiry after Chinese win state contract (BR 20000411a). The march and general strike in 'Cosatu campaign strikes Gauteng' (BR 20000411b) and 'Cosatu gives May Day deadline to business' (BR 20000413). Employment in the KwaZulu-Natal province's textile industry has fallen from 45,000 (1990) to 19,000 (2000) in' Strike gets thumbs down from textile bosses' (BR 20000416). A major South African textile manufacturer later relocated to Botswana citing dumping, illegal imports, and high labour costs. 'SA leaves blanket maker cold' (MG 20001103b)

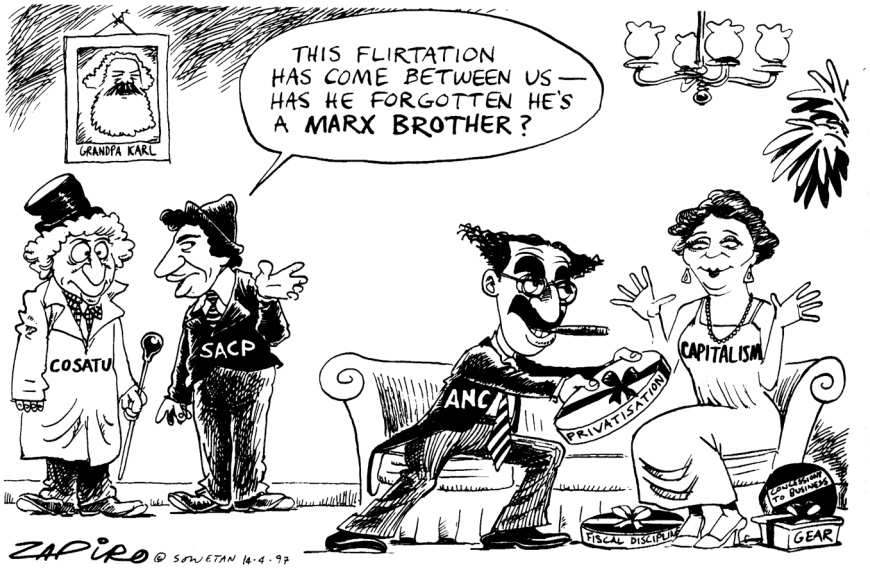

Figure 10 This flirtation has come between us -- Cracks in the alliance over macro economic policy

ANC	African National Congress, the political party that leads government.
SACP	South African Communist Party.
COSATU	The largest trade union confederation.

Source: In Khoza 1998:16

Violence and personal safety in South Africa

The above mentioned 'culture of violence' in South Africa manifests itself as political as well as criminal violence. Violent crime is a major problem that has instilled a fear in most South Africans irrespective of race and wealth. In absolute terms, blacks are affected the most. In terms of the *rate* of declining personal safety, whites have taken the blunt. The perceived level of off-the-job safety is relevant to OHS because it may influence the attitudes of people and the priorities of decision makers while on the job. Three selected extreme incidents from one newspaper over a period of only five days reveal the gravity and omnipresence of this phenomenon.

Friday night in Edenpark, east of Johannesburg, unknown gunmen armed with heavy weaponry (AK-47 assault rifles and 9 mm pistols) entered a shebeen, a bar frequented mostly by blacks, and opened fire on the patrons killing four men and two women. As they fled they fired on another group of people, leaving nine wounded. Monday evening in Johannesburg, a one-and-a-half-year-old child and her mother was in a car outside a house waiting for a relative to open the gate. Gunmen who attempted to hijack their car shot the toddler in the head and killed the mother. Tuesday evening in the Soshanguve

township outside Pretoria two paramedics were assaulted while transferring a pregnant patient to another ambulance. Two attackers suddenly appeared and shot them in the head at point-blank range, killing them. The shooting continued when the attackers hijacked a passing motorist. They shot him in the neck, stole his cell-phone, and took his Mazda Midge.[40]

Innocent bystanders or children are not spared from extremely violent crime. Heavily pregnant women have been shot in the abdomen. Rocks have been put on roads at night to wreck cars after which the motorist is ambushed and killed[41].

Electronic immobiliser systems, which block the engine ignition circuitry, make normal theft of cars extremely difficult. After they have become a standard feature on cars, primarily due to pressures from insurance companies, hijacking has become the preferred method of car theft, stealing the car at gunpoint with the engine running. The practice is widespread. One in four judges at the Johannesburg High Court had over a period of three years fallen victim to a hijacking[42].

While on a factory visit I heard a roar of laughter at the morning coffee break. The amusement stemmed from an attempted hijacking outside the factory gate earlier that morning, which had failed because the nervous hijacker had reversed into a wall, damaging the car. The production manager told me, still smiling, that he thought that everybody in the room had either experienced a hijacking personally, or knew a close relative, who had. The statistics were true for his own family. He had not been hijacked himself, but his wife had. For the rest of that day, while I was examining the details of that company's OHS efforts, I had an awkward feeling that the workplace was safer than the outside environment.

In a 1999 study, comprising both focus groups, in-depth interviews and a nation-wide survey, both blacks and whites cited crime as one of the chief problems of South Africa, if not the chief problem. However, while whites tended to view it as a wholly new phenomenon, blacks saw the increase in crime as more of a diffusion to whites of a problem that long existed, but was cordoned off, within the country's segregated black communities. The two groups also expressed a divergence of opinion on the country's prospects for peace. By an almost 6-to-1 margin, 46 to 8 per cent, blacks believed that peace will last. In stark contrast, whites believed by more than a 3-to-1 margin, 59 to 17 per cent, that there will be more armed conflict (ICRC 1999:39-40). The figures are truly flabbergasting. More than half (!) of the white population felt that there would be more 'armed conflict' -- armed conflict being a benevolent paraphrase for civil war.

[40] Gunmen kill six in shebeen attack (Star 20000422). Baby hijack victim fights for her life (Star 20000425). Attack on paramedics (Star 20000427).
[41] 'Baby born with bullet wound after hijack' (Star 20000330). 'Ambush victim tells of his terror after he hit rock on N12' (Star 20000321).
[42] 'Top judge gets to experience hijacking first-hand' (Star 20000309a).

In response to concerns about lack of personal safety, and perhaps also reflecting doubts if they have a future in the new South Africa, white South Africans increasingly emigrate to other countries. In particular the highly educated ones leave in numbers that has raised concerns if this 'brain drain' may threaten the economic growth of the country[43].

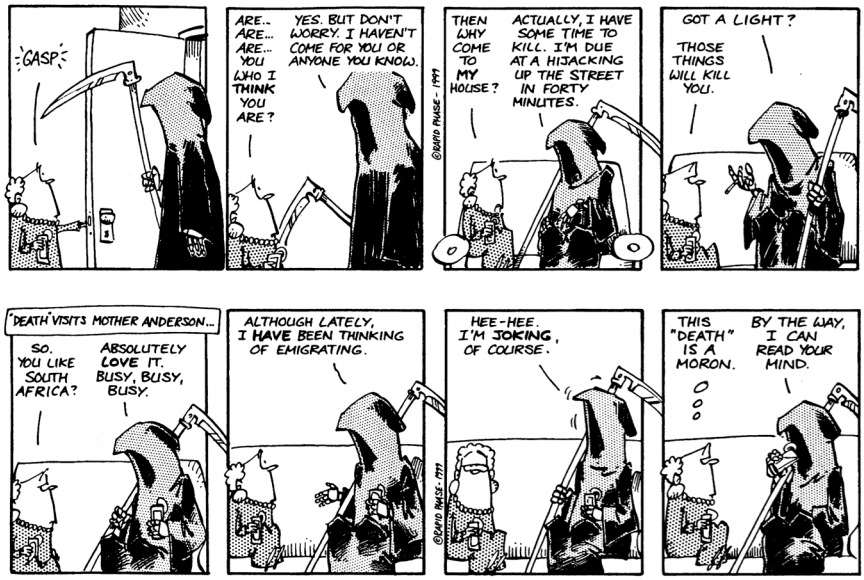

Figure 11 Grim humour in the white suburbs.

Madam and Eve is a popular cartoon in major South African daily newspapers. Madam is an elderly white woman. Eve is a black domestic worker employed by Madam. Both are, in different ways, struggling with the transformation. Madam is habitually depicted with a gin and tonic in her hand, in these strips she drinks one with Death while talking about hijackings and emigration.

Source: Francis et al. 1999:128

Simple transportation involves considerable risks for the black population, of which only very few own a car. They use minibus taxis, usually a Toyota minivan with room for about 10 people, as a means of transportation. These taxis are notoriously unsafe. Poor maintenance of the vehicles, reckless driving, overloading and speeding are blamed for many of the approximately 10,000 road deaths that happen every year in South Africa. Passengers furthermore face risks arising out of a so-called taxi-war between rivalling taxi operator syndicates. The syndicates have taken on 1930s Chicago style gangster methods comprising, for instance, seemingly random attacks with automatic weapons on minibusses of competing taxi operator syndicates. The shooting and killing of passengers are meant to discourage customers of using taxis from the competing taxi

[43] 'Is it any wonder that law-abiding South Africans pack for Perth?' (Star 19991227). "Brain drain `biggest threat` to growth" (BR 20000410).

operator[44]. It is furthermore commonplace to transport people, mostly blacks, in the open back of small pick-up utility vehicles, an unsafe practice known to increase crash severity (Nelson and Strueber 1991)

The reason for dwelling on the issue of off-the-job personal safety is that it could be speculated if there may be spill-over effects into on-the-job safety attitudes. If, for example, it is far more dangerous to commute to work than actually carrying out a day's work, the argument goes, it could be difficult to motivate workers and management to strive for higher levels of occupational health and safety performance. This line of reasoning is essentially rooted in a Maslow type hierarchy of human needs, assuming that humans maintain reasonably accurate risk estimates of the activities they undertake.

The risk homeostasis theory, first laid out by Wilde in 1989 and later elaborated in a 1994 book, claims that humans do so. According to this theory, individuals will engage in more risky behaviour when they perceive conditions to be safer. The theory presumes that individuals have a relatively accurate perception of the level of risk they are subjected to and that they modify their behaviour when the level of perceived risk changes. Empirical support for the risk homeostasis theory has come mostly from the fields of traffic safety and driving behaviour. For example, that ABS brakes have failed to reduce car accident rates because the drivers engaged in more aggressive and, hence, more risky driving behaviour; presumably because the felt safer (Wilde 1994:sec.7.1). But the theory has also been taken onto the OHS scene. For example, Klen (1997:99) reports that Finnish chain saw loggers became less careful, anticipating fewer dangers, after they were equipped with personal protective equipment. It is not my intention to test the propositions of the risk homeostasis theory in the South African setting. The purpose of calling attention to it is merely to add perspective to a complex debate.

OHS and the role of the state

There was a serious fire in a Lenasia, Johannesburg, floor-polish factory in November 2000, in which eleven workers were killed. The authorities announced a general clampdown on dangerous working conditions after it was revealed that the workers had been unable to escape. Doors and gates had been locked because the owner was afraid that the workers would steal items from the factory. It was also revealed that flammable liquids had been stored illegally, next to gas burners.

[44] On taxi violence see for example President Mbeki's State of the Nation Address (Mbeki 2000). Gunmen kill seven in taxi ambush (Star 20000413). Seven die in taxi tyre-burst accident (Star 20000605). Twelve dead in SA taxi smash (MG 20010605). Taxis blamed for surge in traffic deaths (Star 19991217). Hail a taxi and die (Economist 19990516).

"Employers who do not adhere to occupational health safety regulations should expect a zero tolerance approach from the department, which will not tolerate any employer who does not place priority on worker safety," the labour department director general said after the accident[45]. There were, however, also allegations of negligence on the part of the Labour Department, for example, for lumping occupational health and safety inspectors together with other general inspectors, thereby outwatering inspection efficiency[46].

But already in a 1997 document, the department reckoned that it only had about one OHS inspector for every 58.000 workers in the *formal* sector and, furthermore, that one third of its OHS inspector positions were vacant (DOL 1997:8). It is simply implausible that the department should be able to root out unsafe factories through a large-scale inspection campaign.

In addition, the inspection approach is somewhat incompatible with the department's overall labour market policy, which is to create a business friendly environment that promotes and stimulates job creation. Or, as it is phrased in the Labour ministry's 15 point programme for 1999-2004: "...to secure an appropriate balance between security and flexibility in the labour market" (DOL 1999:22), well cognisant that this entails "a need to avoid over-regulation" (ibid:6).

The very high level of unemployment, which ranges from 20 to well above 30 percent depending on the definition used[47], is seen as the root cause for the high level of crime in the society. Hence, employment generation is *the* major challenge facing the department. Indeed, OHS does not even feature in the Department of Labour's seven point list of 'major problems in the labour market', which focuses on unemployment, extreme levels of inequality along lines of race and gender, the legacy of adversarial labour relations, and inadequate protection of certain groups of low-wage earners (DOL 1999:3).

These policy priorities appear to have strong support in public opinion. Two top priorities emerged from a 1999 national survey conducted by the Human Science Research Council: job creation (41 percent) and

[45] Deadly blaze sparks workplace probe (MG 20001120). Biscuit factory dodges safety inspection (MG 20001128).

[46]. It was also revealed that many OHS inspectors were resigning in frustration with the department's alleged low priority on OHS issues -- 97 inspectors had lodged a grievance with the CCMA against the department for the way in which occupational health and safety inspectors have been lumped together with other general inspectors. 'Department knew about death-trap factory' (MG 20001124). Disillusioned safety inspectors claimed the inspectors were inadequately trained, only "counting toilets". 'Department to blame for fire' (MG 20010202).

[47] The narrow definition, which is consistent with international practice, includes only people who are actively looking for work. This rate is 22 percent (27 for blacks, 4 for whites), and rising. The broad definition also includes those who have given up looking for work. This rate is 37 percent (45 for blacks, 6 for whites), and rising. The figures are for 1997, the most recent ones provided by Klasen and Woolard (2000:2,24).

fighting crime (31 percent). Although they were also top national priorities in 1998, they had reversed positions. Crime had been the top priority the previous year (Star 20000309b).

OHS priorities of workers and unions

It is difficult to find information on how workers prioritise OHS issues. A worker representative survey of about 100 unionised establishments in the Johannesburg area in late 1995 provides some information on the topic (Table 7). Worker representatives identified discrimination and poor working conditions and conditions of service as the major problems facing them. 'Poor working conditions' is, however, a concept much broader than occupational health and safety.

Half (52 percent) of the respondents said government regulation should be improved (not reported in Table 7). They wanted inspectors to visit plants regularly and enforce existing laws such as those regulating OHS, indicating that indeed, OHS is a high priority at the workplace (Macun et al. 1997:38)

Table 7 Problems identified by worker representatives

Problem	***Percentage of establishments reporting the problem***
Discrimination and segregation	91
Poor working conditions and conditions of service	47
Trade union capacity and activity	41
Lack of communication	30
Benefits from the company	30
Poor industrial relations	29
Employment policy	15

Source: Macun et al. 1997:38

Despite these espoused priorities by worker representatives in unionised workplaces, unions do not appear to define OHS as one of their top priorities. In the face of the alarming accident rates in the mining industry in the 1980s, described earlier, and despite the union's expressed commitment to OHS as an organising tool, Zwi et al. (1988:700) observed that the union was still able to spare only two

full-time employees for this task. This may be compared to the employment in the mining sector in the second half of the 1980s, which consistently exceeded 700.000 workers (SALS 1995:table 2.2.1.2). Likewise, in the mid-1990s only two (perhaps four) unions out of sixteen COSATU affiliated unions had dedicated health, safety and environmental officers (Magane et al. 1997:184). In October 1998 a minority of union OHS professionals openly complained in a union newsletter that Cosatu was only doing "very little" to push for changes within OHS (Numsa News 1998).

Unions under pressure

South Africa is one of the few countries in the world, which has experienced a rising proportion of the workforce organised in unions over the last 10-20 years. Above all, this is due to the emergence of black unions in the 1980s. An upper estimate for union density is around 50 percent of the workforce (Standing et al. 1996:156-162). Although union membership apparently continued to rise in 1997, this trend was likely due to the growth encouraged under the new Labour Relations Act in previously unorganised sectors. Many, including the then General Secretary of COSATU, Sam Shilowa, believed that membership was actually falling due to unemployment and local structures not functioning effectively (Catchpowle et al. 1998:276). Based on an analysis of a labour representative survey, Macun et al. (1997:39) characterised South African unionism as one that has substantial breadth, but little depth. In their predictions for the next decade, the normally well informed Andrew Levy and Associates, a South African labour consultancy, expect that the pattern seen in other Western economies, where power and influence has shifted away from trade unions, will also come to South Africa (Levy 2000). Unions are thus under pressure.

South African companies have over time sought to use employee involvement structures, e.g. liaison committees, to seek to side-step and weaken union controlled shop-steward structures or simply to avoid unionisation.[48] Unions are critically aware of this danger and remain sceptical of participatory structures that are not under full union control. Phillips from the Trade Union Research Project (TURP) observes that unions have been reluctant to introduce Workplace Forums because they have the potential to undermine the union and perhaps may even conflict with the very culture of a union. "Consultation is a toothless dog", he notes (Phillips 2000:40), while at the same time reckoning that health and safety committees are helpful not to overload shopstewards. The OHS Act (1993) may contain the seeds to conflict, as it makes safety representatives accountable to the workers in general, not to unions.

[48] For instance employers' response to the recommendations of the Wiehahn Commission, as discussed in an earlier section, page 82.

Contemporary restructuring of the labour market may influence OHS negatively

There is rising evidence of a large-scale restructuring taking place in the South African labour market towards converting permanent employees into free-lance contractors. Many companies are forced to downsize because of the neo-liberal economic policies pursued by the Government that gradually reduces import tariffs and exposes the economy to international competitive pressures. Such downsizing and subcontracting of non-core business activities to other firms is one likely motivator for converting permanent employees into independent contractor because it provides them with better hiring and firing flexibility. The same economic policies also seek to stimulate entrepreneur-ship and micro-enterprises, of which many evidently will be self-employed.

This restructuring process may have at least four negative implications for OHS. First, some evidence indicate that **subcontracting tends to influence working conditions negatively** -- companies appear to subcontract the more dangerous work operations to shunt themselves from legal liability and, perhaps, from high costs of worker protection.

For instance, Mayhew et al. (1997:165) refer to USA data where self-employed workers account for 19 percent of all fatal work injuries, but only for 9 percent of the workforce. Mayhew and Quinlan (1997:195) report that the incidence of fatalities is significantly higher amongst self-employed building workers than employees, and argue that subcontracting undermines regulatory standards (ibid:202). Blank et al. (1995) conclude that contractors in the Swedish mining industry seem to get injured more often and sustain more severe injuries. Rebitzer (1995) clearly links outsourcing to disorganisation in the workplace and OHS regulatory failure.

Second, the restructuring is associated with a **growth in the number of small and mediums sized businesses** (SMSEs). The small firms may expect their life-span to be short, hence longer-term planning, investment and staff training may have a lower priority. Evidence in the UK is that small firms experience much higher accident rates than large enterprises (Clifton 2000).

Third, the restructuring process seems to **undermine recently passed labour legislation** regarding worker protection. While tightened labour protection standards were passed with the new Labour Relations Act (LRA 1995) and the new Basic Conditions of Employment Act (BCEA 1997) the Acts specifically exclude independent contractors from their provisions. Converting permanent employees into free-lance contractors many thus be a means of bypassing, not only the stricter, but the entire labour legislation. This could be one likely explanation for the apparent rise in the number of independent contractor arrangements. Some trade unionists claim that

it [... is not uncommon for an unscrupulous employer to disguise an employee's service contract as that of an independent contractor.][49].

An assistant compensation commissioner in the South African Workmen's Compensation system (WCC) told me of a recent case in which a worker had suffered a serious injury in a brick works. But the employer contested compensation coverage because "all the workers were independent contractors" and therefore not covered by the provisions in the compensation Act (COID Act of 1993)[50]. The Minister of Labour has admitted that some firms use labour sub-contracting to escape compliance with tightened labour standards, especially in the construction sector, but can do little about it[51].

Fourth, the restructuring process may **distort established statistics over occupational accidents and injuries**. The self-employed and the independent contractors are excluded from the workmen's compensation statistics. Self-employed workers cannot or do not make worker's compensation claims and their injuries may not picked up by reporting requirements under OHS legislation either (Mayhew et al. 1997:176, Mayhew and Quinlan 1997:195). Effects of such restructuring processes will be masked, understated or missing entirely from statistics derived from worker's compensations claims data (Quinlan 1999:431). Australian data indicate that underreporting of occupational injuries is a problem particularly in the small companies (Larsson and Betts 1996)

It is highly difficult to gauge how widespread independent contractor arrangements are in South Africa, but data on the use of general subcontracting, of which some evidently will be independent, may be taken as a first yardstick. Ulicki (1999) reports that the mining industry is hiring subcontractors for an increasing number of core functions that were traditionally performed by regular workers. Rees (1998:30) reports that 58 percent of companies in the metals and engineering sectors employ contract workers. Horwitz (1995) provides numerous examples: that the chemical industry subcontract non-core work to small businesses, that a forestry company has 50 percent of it forestry work being done by contract workers and a brewery that subcontracts it distribution system to drivers formerly employed by that company.

Using the Internet, a search engine on the South African Labournet service provided an extensive (comprising 71 clauses) standard form "Agreement for the provision of services by an independent contractor to a labour broker" - with a few blank fields, ready for the employee

[49] The phenomenon is also called casualisation -- the turning of permanent posts into freelance posts. In 'Conflict beckons over casual labour and pensions' (Bell 19991217)

[50] Interview Jan 18, 2000, with Assistant Commissioner, Statistics, Mr. H. Flint of the Compensation Fund

[51] Minister of Labour Membathisi Mdladlana in 'State can't stop subcontracting' (MG 20001019)

and company name to be filled in (Labournet 2000). Kenny and Bezuidenhout (1999) report that the Confederation of Employers of Southern African (COFESA) claim to have converted 300,000 employees at 6,000 different companies into independent contractors. In a personal communication, the director of COFESA told me that the figure is now closer to one million (Personal communication, Hein van der Walt, Feb 2, 2000), a claim which was later repeated in a major business newspaper[52].

I will revert to this issue in a later chapter on safety management systems. One large company, which I interviewed, had undergone an extensive downsizing process and used a certifiable management system as a means of control to ensure that OHS compliance did not drop below a certain level of standard in the subcontracting companies.

A new workplace order?

Holdt (2000a) has undertaken a new round of interviews at the same steel company that he studied in detail under the apartheid years, forging the concept of workplace 'ungovernability'. He now[53] reports of a new strategic vision of the union involving an attempt to shape a new democratic order in the workplace and eradicate the legacy of apartheid. The once highly militants union now reckons that it should play a proactive role in increasing productivity and quality.

> "Now that we have a democratic government, we want it to succeed, and of course no political power can be maintained if there is no economic power. Our economy has been devastated by the system of apartheid, and we need to rebuild it now. So I therefore believe that the culture definitely has to change from the culture of resistance to the *culture of productivity*" (Malinga, chair of joint shopstewards committee, quoted in Holdt 2000a:61, emphasis added).

The goal of the union now is to empower the workers and to improve production, recognising that competitiveness is essential for the company to survive.

> "Firstly, our goal is to give more control, more power, to the workers in their activities. Secondly, to make work easier for workers. Thirdly, one of the most important points is to change the relationship between management and workers, so that there should be mutual understanding between them. Fourth, we want to make sure that at the end the workers benefit from the process of producing steel. Fifth, the end result will be more productivity and better quality goods. Finally, not to forget that

[52] 'Letters to the editor: Contracting expands employment' (BR 20000310)

[53] At the time when presenting these far more positive views of the industrial relations system, he was no longer with the Department of sociology at the University of the Witwatersrand, but with the National Labour & Economic Development Institute (Naledi), a trade union institute.

> whatever is happening within the factory or industry must benefit those outside as well. [...] It's either things must continue as they are, and eventually Highveld Steel could close because we cannot compete with other companies; or we say we want to be part of Highveld Steel truly, by committing ourselves to our responsibilities, and sharing part of that cake that will come out at the end" (Nhlapo, chair of steelworks shopstewards committee, quoted in Holdt 2000a:62).

The union identified apartheid's legacy of low levels of education and skills among black workers as the major obstacles to worker empowerment and productivity improvement at Highveld Steel. A massive training programme and a new skills-based grading system were the first steps. The union has also been successful in implementing new forms of work organisation based on multi-skilling, teamwork and greater worker control of the production. Self-directed teams have been formed at the tap floor leading to the removal of the foreman level that normally supervises shop floor workers. In these teams workers discipline each other. Management's disciplinary procedures remain in place only if the problem cannot be solved by the workers themselves (Holdt 2000b:69-70).

Holdt's account is interesting on several points. First, that the official position of the union has changed to one of a responsible and non-adversarial nature, that it acknowledges that market forces and competitive pressures for quality and productivity are essential for survival in a market economy. Second, that the trends in the reorganisation of work mimic those at the international level of 'lean production' and 'flexible specialisation', which involve flatter hierarchies, increased team autonomy, multi-skilling and fewer job-grading categories[54]. Third, that new skills formation structures for blacks are essential in this process. And fourth, that conflicts exist over the removal of the (usually white) foreman level.

For many whites, transformation equals job insecurity

Most changes in the South African workplace are directly challenging white males. To many whites, calls for transformation, non-discriminatory practices, and equal opportunity schemes, are inseparable and indistinguishable from job insecurity fears. Whites may feel tempted and perhaps even feel compelled to emphasise and highlight every possible inadequacy, real as well as imaginary, of blacks' skills and work capabilities in order to justify that whites keep positions and command salaries, which are far higher than those of blacks[55]. It is ironic, if the breakaway from the racist apartheid workplace regime in this manner spurs espoused racist attitudes.

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[54] See for example MacDuffie and Pil (1997) for an overview of lean production

[55] There were, for instance, racial undertones in the critique of the insufficient DOL labour inspection efforts that was voiced after the Lenasia floor polish factory fire. It was suggested that transformation had driven white competent

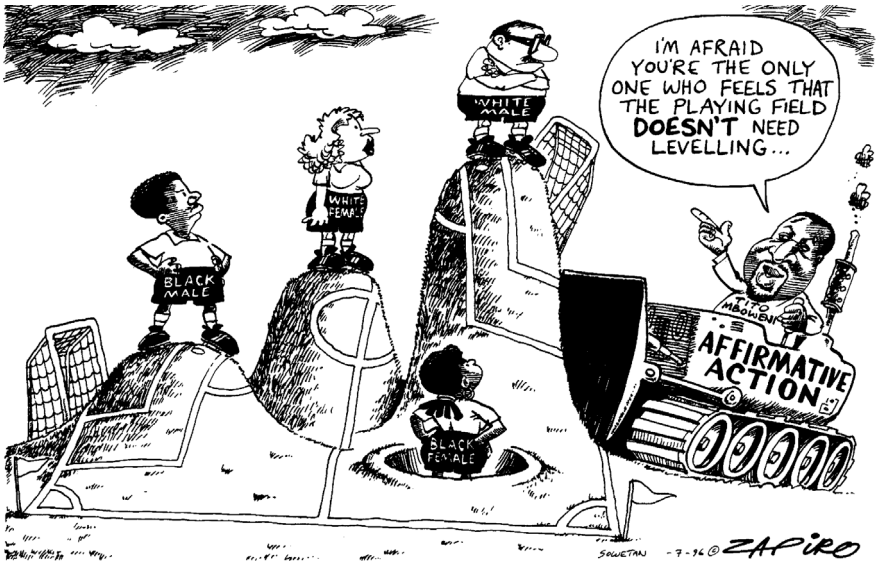


Figure 12 Affirmative action policies pursued by Tito Mboweni, then Minister of Labour

Source: in de Klerk 1998:18

This may be particularly true for OHS 'safety manager' and 'safety officer' positions in medium sized and large companies -- positions which have traditionally been occupied by whites. Upper management may see OHS as an ideal area in which to nurture black middle-layer professionals. OHS issues are intricately connected with everyday work life and could be a natural first choice for initiatives aimed at improving communication between (white) management and the (black) shop floor.

There are several lines of reasoning, which would lead to the conclusion that blacks are promoted into these positions. There are the obvious reasons; that blacks are able to communicate with the shop floor in an African language[56]. Many blacks speak more than one African language, few whites do so. There are also more subtle reasons. The appointment of a black safety officer is a visible signal that employment equity and affirmative action policies are in fact being implemented. It could be speculated that if management are to give concessions to the shop floor it would be opportune if a black safety officer takes the credit for it.

inspectors out, leaving the departments with only inexperienced inspectors. 'Department to blame for fire' (MG 20010202)

[56] There are eleven *official* languages of South Africa. The five most commonly spoken home languages are IsiZulu (22.9%); IsiXhosa (17.9%); Afrikaans (14.4%); Sepedi (9.2%) and English (8.6%).

The unemployed and those in the informal sector

Finally, concerns over the wellbeing of another population group is increasingly appearing in the South African public debate -- the unemployed, the most vulnerable of the labour market.

This chapter has dealt extensively with the formal structures of the industrial relations system, the new councils and forums where organised labour, organised business, and the government negotiate and seek consensus. The unemployed, in principle represented by government, have no strong voice in these new structures. Nelson Mandela acknowledged that the unemployed and the unions have different interests, saying that the ANC cannot "... act as the political representatives solely and merely of the progressive, organised and employed sections of the working class ... The ANC represents the people as a whole, and the African working masses in particular." (Mandela 1998:42).

Neither have those who make a living in the informal sector of the economy benefited from the increased levels of worker protection as promulgated in new labour legislation, the LRA and BCEA. Data on the informal sector are sparse and it difficult to ascertain their reliability. It appears that the informal sector created more than 1 million jobs between 1996 and 2000. At the same time the formal economy was shrinking. Informal and domestic service now makes up about one-quarter of total employment[57].

In fact, if tightened legislation simply causes the economy to shed jobs in the formal sector, that will only benefit those who remain employed in that sector. Business organisations have argued that the present labour regulation imposes significant additional costs on business, constitutes a high 'hassle factor' associated with compliance, and robs the business owner of control and flexibility. This impedes job creation (Sacob 2000a, 2000b:5). President Mbeki appears to be sensitive to these views[58].

[57] Jeremy Baskin in 'The facts behind the figures' (MG 20001127)
[58] See for instance his State of the Nation Address (Mbeki 2000) or ' Labour laws killing small business, says Mbeki' (MG 20000216)

Figure 13 The LRA and the unemployed

The governments after 1994 have passed major pieces of new labour legislation to enhance the formal rights of workers

Source: In Khoza 1998:16

Essentially, this is an argument in favour of deregulation. Certainly, it is an argument against increased regulation and other burdens (taxes) laid on the business sector. I will revert to this issue when discussing interventions in small enterprises (SMSEs)

Concluding remarks

There are thus many indications that workplace relations are changing towards being more co-operative and less adversarial. The industrial relations system has been transformed and social cooperatism is being pursued. New bodies (Nedlac) have been established to enhance social dialogue and provide a mechanism for problem solving and conflict resolution. The conflict ridden wage negotiations issues have been lifted from the firm level to negotiations at a meso-level in NBFs.

Holdt gives an account of a union, which was highly militant during the apartheid years, but now espouses concerns over the wellbeing of the broader community, accepts the competitive conditions of the free market, and appears to pursue a 'culture of productivity' -- truly a remarkable transformation to a mature and responsible organisation.

Macro economic indicators point in the same direction. Strike action hit a ten-year low in the year 2000. Indeed, Webster's (1997) fears of an unstable molotov cocktail may be about to be defused.

On the other hand, it would be presumptuous to assume that deep-seated inequality and frustrations accumulated over generations can be

dismantled over a time span of only few years. Indeed, many of my observations suggest that conflicts lurk just beneath the surface. It is also an open question how unions will deal with joint OHS safety committees, well knowing that such forum in the past have been deliberately used by employers to weaken or bypass the union movement.

At the very least, contemporary South African workplace conditions cannot be understood without maintaining some longer-term perspective that also comprises conditions under the apartheid years. It has been a purpose of this chapter to provide the reader with that perspective.

Chapter 6. Case studies on two cleaner production projects

Key lines of reasoning of this chapter

Overall structure

This chapter reports the findings of two case studies. The first is on the fish CP project, in which I followed the implementation consultant in the project's early implementation phase. The second is on the metal finishing case study, in which I followed the planning consultant during the project planning phase[59]. In between comes a short documentary analysis of en evaluation report issued by the Danish National Accounting Office (NAO). This chapter thus covers the findings from research activity 1 and 2 as marked on the earlier Figure 3 (page 30). The reader is referred to to the overview description on pages 31-33 for a short intro on how these two study activities relate to the other research activities of this thesis.

The sequencing of the two studies is slightly unusual, first looking at implementation, and then at planning. This reversal of the normal order of a study only reflects chance -- that the first study, which I had a chance opportunity to follow, was in its implementation phase. Some of the insights and hypotheses generated in this study influenced the next study involving the planning phase. The original order of those two case studies has therefore been maintained in this description.

The fish case study

The first study on the fish project (the implementation phase) will start with an examination of the very first the theme raised in chapter one -- that cleaner production projects may be undertaken narrowly with little or no attention paid to occupational health and safety. Documentary analysis of the Project Document (PD) will confirm that this is indeed the case.

[59] Note that the two consultants referred to here are two different individuals. To maintain a clear distinction, this study will refer to them as the *implementation* consultant and the *planning* consultant, respectively.

The case study will then look into the causes of this state of affairs. The implementing consultant who was responsible for implementing the fish CP project on behalf of Danced plainly felt that OHS was outside the scope of his job description. OHS was simply not perceived as a legitimate project objective. The case study will therefore look into the *processes of interpretation* of which objectives the project legitimately should strive to attain. The reader is reminded that there are forces at work that may disorganise and fragment a 'cleaner production project', which is characterised by many distinct phases, carried out by different individuals in agent-principal relationships, and in which written documentation, the PD, is the main carrier of information. The implications for an agenda of integration will be examined.

A slightly intricate hypothesis will be pursued. It will be argued that the planning consultant *initially* contemplated that the CP project should focus on issues of CP environmental management, i.e. a *process* approach to CP. This was unattractive, however, to Danced, which prefers projects with unambiguous, quick, visible, measurable and cost-effective results. The weight of the project was therefore shifted towards a *technology* oriented approach to CP, which focus on the introduction of new and more environmentally friendly production equipment. Hence the focus of the Project Document (PD) on investment subsidies. However, the implementing consultant *re-interpreted* the PD and decided to pursue an environmental management process approach to CP, as originally contemplated by the planning consultant.

Rigour versus relevance

What should motivate this twisting of project objectives? This chapter offers two different sets of explanations.

The first concerns the LFA planning tool. It will be argued that the LFA tool is not a benign tool that merely helps to structure and streamline a project. Rather, it entails a real risk that it will distort a project due to its obsession with quantifiable indicators. It will be argued, that indicators are the tail that wags the LFA dog. This discussion introduces a key theme that runs through this chapter -- the *dilemma of rigour versus relevance*[60]. If the rigour of planning is adhered to, we have to sacrifice relevance of project contents. On the other hand, if only relevant project objectives are pursued, we must sacrifice the rigour of planning. This discussion kicks into an analysis of the events and experiences of the CP project, as they are illuminated by two competing sets of theories -- that of Rational Choice, and that of Bounded Rationality. Again, based on documentary analysis of the Project Document , we will look for evidence of standard rational planning and competing evidence of garbage can processes.

[60] This dilemma was first introduced in the discussion of the action research type on page 26.

The political context

The second set of explanations concerns the political environment in which Danced operates. It will be argued that rivalry with Danida motivates Danced to strive for efficiency as a means to justify its existence. It is imperative for Danced to be more efficient than Danida. It will be argued that Danced therefore prefers bang-for-the-buck projects in which visible and measurable results are achieved within short timeframes for limited budgets. This returns the focus to indicators: how to demonstrate unambiguous success of a CP project. This focus on indicators entails *rigour*.

Additionally, that broad political support for Danced is, at best, murky, perhaps even non-existent, and that an unsympathetic political opposition keeps a watchful eye on Danced's performance. These pressures motivate Danced to emphasise *rigour*, to go-by-the-book, following the procedure laid out in the systematic and rational planning tools, that is: the LFA, to the letter. It will be argued that the projects thereby sacrifice on *relevance*, i.e. a return to the underlying theme of this chapter -- the dilemma of rigour versus relevance. In its examination of the political themes, this chapter will draw on documentary analysis of an evaluation report by the National Audit Office (NAO).

The metal finishing case study

The next case study on the metal finishing project (the planning phase) will examine the problem analysis phase in more detail. It will be argued that this is a messy affair with conflicting evidence and unclear cause-effect relationships. The metal finishing sector spans wide, from very small environmentally irresponsible firms to large corporations that act responsibly. The small-firm sub-sector is large, highly fragmented and disorganised, sometimes anarchistic, with backyard and moonlighting cowboy operators working from makeshift facilities. In complete contrast is the large-company sub-sector well organised in an industry association that effectively speaks on behalf of the whole sub-sector. This chapter will argue that the small firms are the most needy for assistance while the large companies in many respects have the resources to help themselves. It is plausible that the large companies also pollute less than the small firms.

How does the LFA planning tool perform in this messy setting? -- and how do the preferences of Danced for bang-for-the-buck projects in combination with the realities of the political context manifest themselves? The chapter will argue that from an environmental point of view, the small firms are highly *relevant* to target. However, they do not meet the *rigorous* requirements for eligibility to receive support. On the other hand, that the large companies probably are less *relevant* to target, but they meet the *rigorous* requirements laid down for support.

Implications for integration

In between this chapter's concern with the rigour versus relevance dilemma, it will discuss the implication for integration of CP and OHS. Based on insights from the fish case study it will be argued that OHS issues must find their way into the project specification, especially concerning its mechanisms for reward and blame, that is: accountability. Following the terminology laid out in Chapter 3, this is integration at the *structures* level. In the metal finishing case study, this type of integration is attempted, letting OHS issues feature in objectives, outputs and indicators of the LFA matrix.

In the fish case study, the chapter will furthermore look into the methodology the implementing consultant employed in his endeavours to motivate the large fish companies to adopt CP environmental management. A description and analysis of this methodology is relevant, because it led to the hypothesis (hypothesis *generation*), that OHS could be integrated in this type of top-down management approach. Following the terminology, this is integration at the *tools* level. The discussion in this chapter thereby sets the stage for the next Chapter 7, which is devoted to an empirical test of this hypothesis (hypothesis *testing* research activity).

The fish CP project

Absence of OHS issues in the fish Project Document

Analysis of the fish CP Project Document (PD) seemed to confirm the initial hypothesis of this study; that CP projects may be implemented with a narrow focus on environmental outcomes only. There is only very limited mention of OHS issues in the first two sections of the otherwise lengthy PD; if fact so limited that it can be quoted in full below. The numbers refer to the section numbering in the PD.

1 Background and context

1.4 Socio-economic context

> "The fishing industry is hazardous in terms of occupational health and safety issues ..." (Danced 1998:1-7).

2 Analysis

2.1 Problem analysis

Nature of the problem:

"The environmental problems fall into 4 groups:

- Smell and poor visual environment around the fishing factories
- Marine pollution of the coastal waters
- Resource use of water, fish and energy
- Health and Safety in the Work Place *including hygiene*" (Danced 1998:2-3, italics added)

Section 1 of the PD, which stages the background and context of the project, identifies the fish industry as 'hazardous' but provides no further information on neither the nature nor occurrence of those hazards. OHS then briefly reappears in the problem analysis in section 2 as being part of 'the problem' but OHS issues are not considered in more detail. Several opportunities foregone to introduce OHS can be identified. The section on stakeholder analysis identifies the dominant union FAWU, however only insofar as the union "expressed a keen interest in environmental matters" (ibid:2-6). The analysis on the broader dissemination of project results and general CP awareness creation states that "Environmental NGOs, and local environmental interest groups and a well informed industry can be efficient promoters of clean environment" (ibid:3-5) thereby ignoring the earlier mentioned FAWU union as potential promoters of CP. In annex D (Legal framework), the analysis of noise, a suspected 'twin problem', is only analysed in terms of the Environmental Conservation Act, the Aviation Act, etc. (Danced 1998:D-9).

The attention given to OHS in the PD can thus be characterised as quite superficial, also evidenced by the ill-placed "*including hygiene*" comment, which makes little sense. The PD shows signs of having been prepared without any initial attention to OHS and only at a very late stage, for cosmetic reasons, of having had OHS issues 'added-on'. During a conversation with a Danced official, he reckoned that the fish project "paid lip service" to OHS without dealing genuinely with the issue.

The Danish consultancy Dansk Teknologisk Institut (DTI) had won the task of implementing the fish CP project in South Africa. The lead consultant from DTI, henceforth the *implementing consultant*, told that he had not given much consideration to OHS issues in the bidding phase. He simply felt that the topic was outside the scope of the project. He reassured me however, that, of course; he would not approve of any investments in cleaner production technologies that would cause a deterioration of OHS. He was unclear, though, on how he would determine if a specific investment proposal had the potential to cause such deterioration.

Integration required to make OHS a legitimate project objective

As discussed earlier (Chapter 2, page 20), the Project Document (PD) is of paramount importance, as it is the glue that binds together the complex and disorganised web of actors and activities that constitute an environmental project. The PD constitutes the contractual basis between Danced and the implementing consultancy. The PD lists a number of objectives that the project must achieve in conjunction with a set of indicators of how to verify if those objectives have been met when the project ends. The PD is therefore also an instrument of control that holds the implementing consultant accountable for his performance on the job.

Based on the contents of the PD the implementing consultant may therefore conclude that OHS is not a legitimate project objective. Had it been so, he could rightfully reason, it would have been included in the list of objectives. A first, and very early, finding of this study was thus that OHS must feature in the PD, that is, integration at the 'structure level' in the terminology introduced in Chapter 3, page 45. If the PD is silent on occupational health and safety issues, it is likely, and natural, that the attention given to occupational health and safety issues during the project cycle will be minimal, if any attention is paid at all.

What are the legitimate project objectives? -- examining the LFA matrix

Returning to the fish PD, it is interesting to examine the types of objectives that this project legitimately should strive to attain. Relevant excerpts from the LFA matrix are presented in Table 8 overleaf.

There are two levels of objectives in the LFA matrix. The super (development) objective is to reduce the pollution from the fish industry to comply with international standards largely due to a preventive approach. The super objective can be attained by accomplishing three lower level project (immediate) objectives, which are 1) to implement CP processes and practices, 2) to develop CP capacity within the industrial sector, and 3) to increase the general awareness within the industry on the positive benefits of CP.

The second column, verifiable indicator, is very specific for the immediate objective 1 only, comprising, for instance, a 50 percent reduction in the water usage in the canning industry. Specific means of verification are suggested for this objective in the third column, sampling and measurement plans. For immediate objective 2 the indicators are more vague, and none are listed for objective 3. Regarding means of verification, none are listed for objectives 2 and 3. Focus is clearly on the easily quantifiable and visible measures; above all: water savings.

To attain the three immediate objectives a number of activities must be carried out (not shown in the abbreviated LFA matrix in Table 8). Those activities are grouped into four major components: training, assessments and actions plans, physical investments, and, dissemination and monitoring.

1. **Training component**. The purpose of the training is to boost practical knowledge on cleaner production. The major training activity is a study tour to selected Danish fish industries, which have successfully implemented CP option. "The candidates participating in this training should be fully equipped to go-back-home and make environmental assessment of their own companies; their 'toolbox' should therefore also include a generic

Terms of Reference for such plus the format for applications to Danced [...] for incentive grants. Other useful 'tools' could be manufacturer's catalogues, lay-out examples, compendium of key figures on equipment water usage, environmental key figures (energy per ton raw material, etc.)". (Danced 1998:3-7)

2. **Assessments and action plans.** The desired result of the second component, environmental audits, assessments & action plans, are: "The result of this phase will be the environmental action plans developed by the factory themselves, possibly with some input from private consultants […]. This plan should contain suggestions as to short, medium and long terms actions: CP project descriptions including detailed investment schedules and an Environmental Impact Assessment. To assist with special or generic problems the Danish lead consultant could be asked to provide international experts." (ibid:3-8). For this component, Danced grant a lump sum subsidy to individual companies which is expected to cover about 25 percent of the cost[61].

3. **Physical investments**. Regarding the third component, actual implementation, Danced may grant a 20 percent subsidy to investments and improved management practices. It is noted that: "A focus should be maintained on good housekeeping which costs little but is probably harder to implement. (ibid:3-4).

4. **Dissemination and monitoring**. The fourth component comprises information activities targeted at stakeholders, the general public, production of progress reports, newsletters etc.

[61] A typi cal study is estimated at R 40,000, equivalent to the cost of a local consultant for about one-month. Bearing in mind the quite comprehensive scope of the studies, which should produce detailed plans for implementation, it would appear, that the studies would deal mainly with cost-benefit evaluation of different solutions and only to a modest extent with analysis and search for solutions.

Table 8 Excerpts from the LFA matrix for the fish CP project

Objective	*Verifiable indicators*	*Means of verification*	*External factors and critical assumptions*
Development objective: The negative environmental impact of the South African fishing industry reduced to comply with international standards, largely due to a preventative approach	Pollution reduced and environment round the fishing industries improved.	Visual improvements, Benthic zoological surveys, End of pipe measurements	That the fishing industry is interested to make use of the facility That the availability of quotas and the general economic conditions for the fishing industry do not change negatively
Immediate objectives: 1. Cleaner production processes and practices implemented in the canning and white fish industries with sustainable results	Sustainable reduction in water usage (50 % in canning, 25 % in white fish) Reduction in pollution load in the effluent to meet South African standards Increase of production yield through resource recovery (1 % in canning, ½ % in white fish)	Sampling and measurement of water usage Sampling and analysing of effluent streams Measurement of yield	The involved factories implement cleaner technology either in the form of improved management and household practices or by actually investing in new technology or measures to improve the production
2. Sustainable and accessible capacity within the sector to further implement and develop cleaner production processes and practices	Sustainable ISO 14001 certification Ability of in-house technicians, local consultants and FIRI to further develop and implement CP.		
3. Increased awareness amongst the general public and the fish industry sector in particular on the current negative environmental impacts of the sector and the possibilities and opportunities to mitigate these impacts through the introduction of cleaner production processes and practices			

Source: Danced 1998:Annex A

The LFA matrix -- indicative of an equipment approach to cleaner production?

It can be argued that the project, as its components and its activities are laid out, invites to a relatively narrow 'equipment focused' understanding of CP -- as a transfer of more advanced technology, i.e. better equipment, which has shown its worth in the Danish fish industry.

The study tour, the assessments and, indeed, the subsidy component, all relate quite narrowly to equipment issues. The LFA immediate objective level 1 output indicator: 'reduction in water usage' does also appear to support this interpretation, certainly it does not contradict it. The observations that "a focus should be maintained on good housekeeping which costs little but is probably harder to implement" further tend to reinforce the narrow focus on equipment issues rather than softer issues such as work practices.

Hence, it would not be unreasonable to presume that the implementing consultant, who in principle only has the information in the PD, would interpret the main idea of the project in the following manner: 1) the study tour could focus on presenting practical equipment solutions, 2) the feasibility studies could focus on ranking their application in South African industry in terms of economic feasibility and 3) the equipment could be acquired by means of the investment subsidy.

A danced executive expressed a similar understanding of the project. He expected that all major decisions in the project would be made within 'the first half year or so'. This is only plausible if major decisions are perceived as physical investment decisions.

The implementing consultant's approach to cleaner production

The Danish consultancy DTI had been involved in several CP projects with Danish fish companies. The experiences gained there had lead to the development of a particular DTI approach to CP. This approach was presented to the industry participants during the study tour. The DTI approach had three major dimensions 1) what to focus on, 2) how to do it, and 3) why it should be done.

Regarding the first dimension, the DTI concept of CP listed five major intervention areas: 1) good housekeeping practices, 2) change/modification of processes, 3) change of raw materials, 4) re-use, and 5) re-cycling of material streams. Moreover, regarding the second dimension, the most efficient and sustainable way to carry out CP was to enter environmental management, specifically the so-called management cycle, the implementing consultant said.

In a presentation to the study tour participants, the implementing consultant made the following presentation of environmental management (Figure 14). The process starts with an environmental review leading to an *environmental report*. The company shall then define its environmental policy and in accordance herewith set *priorities*. The company will then define specific objectives to be achieved and make *action plans* to achieve them. A monitoring plan is required to provide key *environmental figures*, which can be subjected to a formal audit control mechanism.

The management circle is completed with the management review, which leads to a revised environmental report, and the setting up of new priorities and objectives, and the process will start a new cycle.

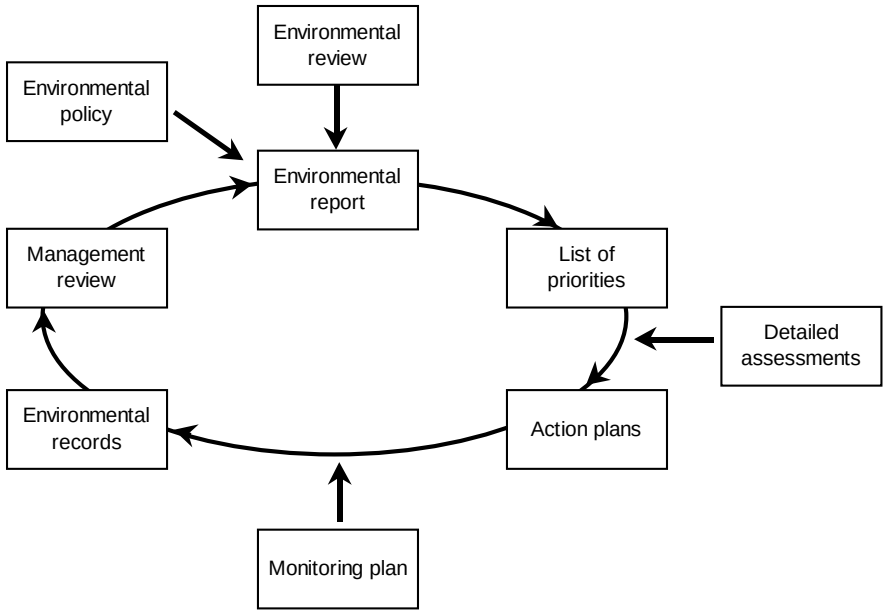


Figure 14 The DTI approach to cleaner production

Source: DTI Cleaner production Presentation by Mr. Lars Seiersen (DTI) April 8, 1999. Hotel Skagen, Denmark

The implementing consultant emphasised the methodology of the management circle and likened it with rolling a ball uphill (Figure 15). The rolling movement is the continual application of the Plan – Do – Check – Act and Analyse, in shorthand the PDCA circle.

In the literature this is known as the Deming planning circle -- a method of problem solving often referred to in the quality management literature. A triangle prevents the ball from rolling back downhill if no longer pushed. The triangle represents written standards, specifically a 3-tier hierarchy of management guidelines at the top, followed by a procedures manual and finally written instructions.

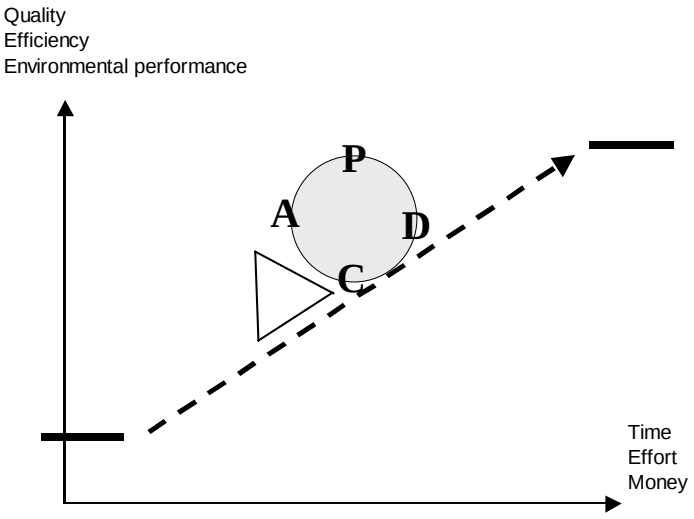


Figure 15 The Deming circle in environmental management -- emphasising a systematic approach, which is applied continuously

Note: The Deming planning circle is also known as the PDCA circle
PDCA: Plan – Do – Check – Act & Analyse.

Source: DTI Cleaner production Presentation by Mr. Lars Seiersen (DTI) April 8, 1999. Hotel Skagen, Denmark

I was able to find a similar visualisation in the total quality management literature (in Willems 1994:177) in which the vertical axis is the *level of control*[62] that management has over operations when employing total quality management (TQM) principles. This visualisation is repeated here in Figure 16.

The Danish experiences with cleaner production had clearly shown that this approach was the most efficient one to implement it in the most sustainable way, the implementing consultant said.

The third dimension of the DTI approach, why should you embark on CP, the answer was unambiguous: to save money. The training material consistently supported this view of CP. Matcon, another Danish consultancy, which were active in a Danced CP project in Namibia, had prepared a 'catalogue of ideas' for CP options in the fishing industry that was included in the training material. This catalogue simply reads: "From the Danced perspective, cleaner technology is a comprehensive, preventive approach that has practically demonstrated that '*pollution prevention pays*'. (Matcon 1999:Gi010-1, emphasis added).

[62] I will revert to the terminology of management control in the next chapter

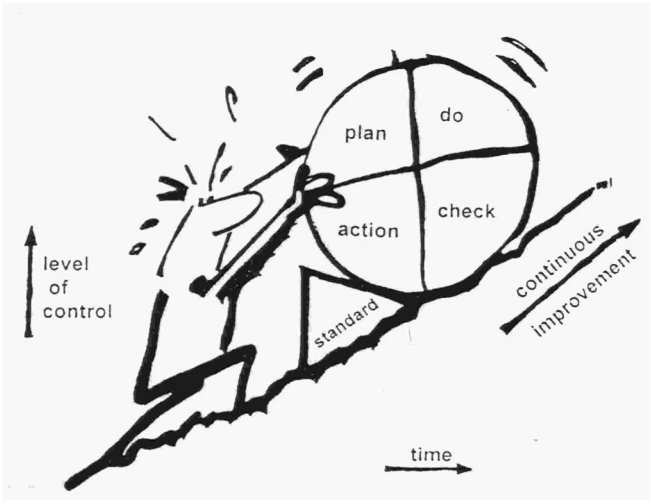


Figure 16 Continuous improvement by applying TQM principles

Source: Willems 1994:177

Many who advocate CP do so with within a cost-efficiency discourse. I came across an iceberg representation of costs in an article on chemical supply chain management, a later CP development that seeks to optimise relations between suppliers and consumers of chemicals. Both parties benefit financially from this supply chain business relation and the environmental performance is also improved, primarily due to waste minimisation. I have included the visual iceberg representation of the cost here (Figure 17) for two reasons. First, that it in a fine way epitomises the CP rhetoric on pollution-prevention-pays. Second, that it resembles a quite similar but much older discourse within the OHS domain, introduced by Heinrich in the 1930s, a topic I will revert to in Chapter 7.

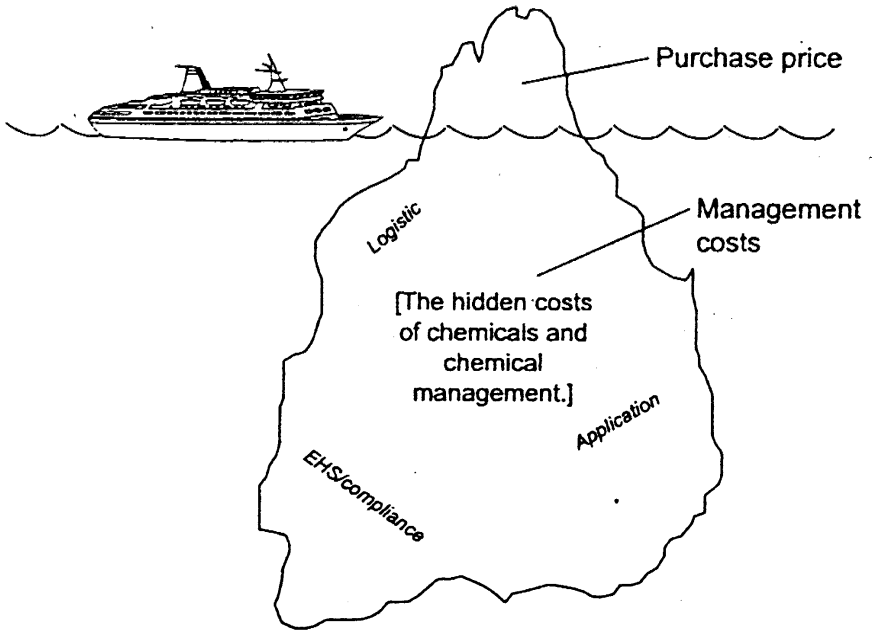


Figure 17 The chemical cost iceberg in cleaner production

Source: Bierma and Waterstraat (1999:147)

Summary of DTI concept to cleaner production

Four major component can be identified in the DTI approach to cleaner production. They are:

1. The **major driver** is economic cost-efficiency and sound business rationale. This is achieved through a combination of less wasteful use of resources, primarily water, and a higher yield accomplished through improved recovery of valuable product, primarily fats and protein that can go into the animal foods business, that would otherwise end up in waste streams.

2. The **implementation methodology** is the application of a systematic and formal 'management system approach' based on systems, procedures and manuals, emphasising continuous improvement. Important milestones in the process are defined by the timely production of written documentation, in particular the production 1) of an environmental report, 2) of a policy document, 3) of exact environmental objectives, 4) of written responsibilities and work procedures, and 5) a manual. The approach owes obvious intellectual debt to developments within quality management.

3. The process is **expert driven** and the approach is systematic, formal, and control is exercised though hierarchic and bureaucratic rule. The approach is of a top-down type, starting with management commitment and orders are assumed to cascade down through the organisational hierarchy in an autocratic manner. The process is championed by an in-company expert, who is usually located in a staff company position.

4. There is **little involvement of the employees** at the shop floor. Many activities are focussed towards changing established work practice. The workers are requested to be co-operative, but they are generally not asked for their advice or suggestions in this process.

The DTI concept bears resemblance to the ISO 14000 approach to certifiable environmental management systems, although the DTI system, the implementing consultant stressed over and again, was based on an absolute minimum of paperwork. An efficient 'quick and dirty' approach gave good results. The environmental report, for example, should be no longer than 12 pages.

The implementing consultant also repeatedly stressed that while the DTI concept was not certifiable in a strict sense, the concept would prepare the company to environmental management methodologies. It would thereby pave way for a later ISO 14000 certification, should the company be interested in doing so.

I later asked him if his description of the amount of written procedures required for an ISO system wasn't overly simplistic, for instance ignoring the requirements for detailed job descriptions. He answered that he deliberately downplayed those bureaucratic aspects. He just wanted them to get started. Once started, he would exert maximum pressure to make them continue their efforts. The hurdle was to get them started. He thereby pursued a clear *process* approach to CP.

The study tour participants

During my conversations with the study tour participants, several company representatives expressed interest in an ISO 14000 environmental management certification although they also had reservations about what they perceived as excessive paper work and an overly bureaucratic nature of such a system. Many companies were seeking to enter export markets and an ISO 14000 environmental management certification was perceived as an important, although not critical, competition parameter. Many companies were already familiar with formal certification schemes, in particular the so-called HACCP[63] scheme used in the food industry. Some companies were also considering ISO 9000 series quality management certification schemes. The DTI concept appeared to have appeal to them due to the pledged minimal amount of paper work involved and the promised level of control over the change process it would bring about.

I also sought to inquire why they took part in the project. Curiosity was a common reason. Most middle management of South African industry had lived in isolation during the apartheid era sanctions. The participants were curious to see the environmental standard of the European industry, against which they had a desire to compete. Many participants also felt a need to become aquatinted with new environmental concepts because the South African environmental legislation was in the process of being tightened.

A common motive was interest in the subsidy element, which was available for investments in new plant hardware. Many representatives gave accounts of a cash-strapped industry, which faced an uncertain future. The prime source of uncertainty was allegedly associated with the fish quota system. A new Act[64] had recently been passed which took the quota distribution from a Quota Distribution Board and put it with the minister. The ownership structure and management level in the fish industry was mostly white and they openly wondered if the government would continue to allocate fish quotas to whites, or if affirmative action policies would shift fish quotas to consortiums with black ownership. This created considerable level of uncertainty in industry, which, I was told, also affected investment policies. The industry had a short-term perspective and there was little desire (or will) to embark on long-term investment projects. The plant hardware subsidy was therefore highly welcome. During my later visits to the plants of some of the participants, the attractiveness of the plant hardware subsidy element was again highlighted to me. Some of the interviewees had very specific wishes to new types of plant hardware. For instance one

[63] HACCP - hazard analysis and critical control point - a certifiable scheme in the food industry, which is often required for gaining access to export markets. It covers good manufacturing principles related to hygiene and product quality.
[64] Marine Living Resources Act, No.18, 1998, under the Department of Environmental Affairs and Tourism (DEAT)

interviewee[65] was interested in a new unit that thawed frozen fish using heated air, replacing one that used heated water, which he had seen at a visit to a Danish equipment manufacturer during the study tour. That new unit would bring about a substantial reduction in water consumption.

Certainly, the commercial and legislative environment in the fish industry exhibits special traits. For instance, during a visit to a fish canner[66], I asked the factory manager to the surprising tranquillity of the factory works. His responses concerned production over-capacity and uncertainty. Despite the fact that there are seven canning companies in South Africa, he claimed that his factory alone had enough processing capacity to supply the entire domestic market (the export volume of canned fish is negligible). He also lamented about quota uncertainties. A company group profitability study had suggested that a smaller canning facility up-coast be closed. However, the authorities had indicated that the resulting loss of jobs would likely result in a lower company quota for next year in order to render this option unattractive to the company.

Potential conflicts over the handling of the subsidy

The plant hardware subsidy also became a potential source of conflict. How should the subsidy be administrated? Should it be on a first-come first-served basis or should some other set of criteria be applied? Some of the industries were in a more advanced stage of undertaking an environmental review than others, etc. The participants decided to pre-empt this conflict in a decision to delay the investment subsidy decisions. It was decided that the project management steering committee should not consider applications for subsidies to plant hardware until after one year.

This conflict and the management committee decision that it brought about, were highly welcome to the implementing consultant. His strategy, he told me, was to pursue a fast implementation of the DTI concept at the companies. He wanted to get the organisational process at the companies started, of making a coarse environmental audit, defining some objectives to be attained, and then to take the necessary steps to fulfil those objectives. In fact, he asserted that he "couldn't care less" about the specific nature of the initial objectives that the companies defined, because he would expect the companies to revise those objectives anyway, as a natural consequence of the 'management review' element, in the DTI management cycle. He also indicated, that the extent to which the companies were able to go through several cycles of the process, i.e. of setting goals, attaining them, and then setting new goals, would be an important criteria that would go into his

[65] Talked to Engineering Manager Suleiman Salie, Irvin and Johnson, Woodstock, Cape Town, June 10, 1999

[66] Talked to Director Production Adrian Smuts, St Helena Bay Fishing Industries, Stompeneus Bay, June 11, 1999

considerations of which companies would be eligible for capital investment subsidies.

The study tour questionnaire

I ran a small questionnaire survey amongst the study tour participants from the fish industry (Hedlund 1999). The results (Figure 18) indicated that whilst there were mixed feeling towards bureaucratic management systems this was not deterring them from entering into such systems. In Q25 when asked if they already have a certified control system, the respondents refer to their HACCP certification, only two respondents were in companies that were ISO 9000 quality certified.

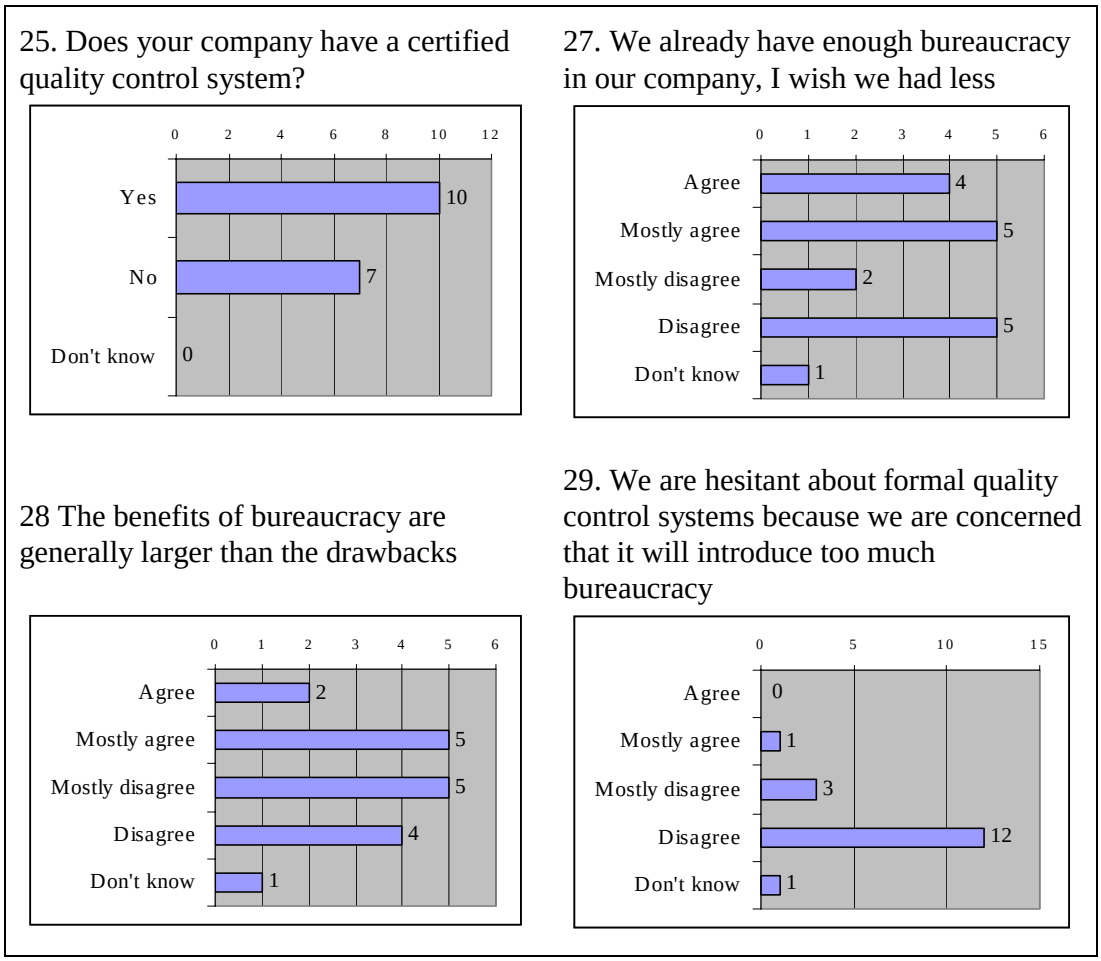
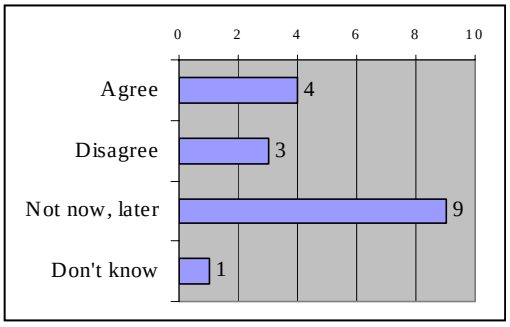


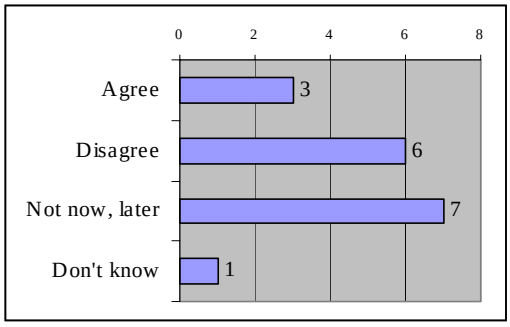
Figure 18 Views on bureaucratic management systems amongst study tour participants

The questionnaire results also indicated (Figure 19) that the major drivers for improving the environmental performance were related to conflict with the local community and with environmental authorities, not because of a perceived demand from customers or consumers. A majority expected that customers or consumers would voice such demands in the foreseeable future, here defined as within 5 years. The most important driver is sound economic feasibility

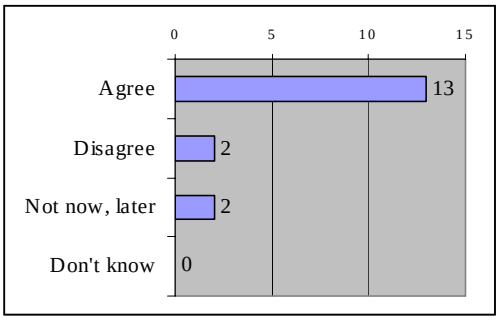
19. Our customers demand improved environmental performance of our company



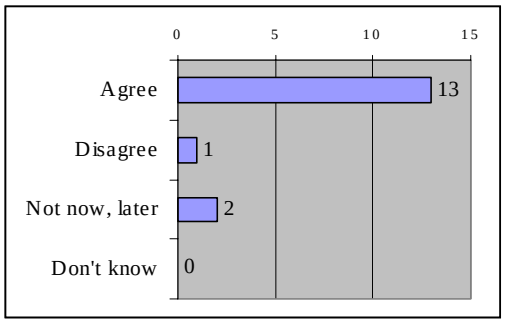
20. The consumers demand improved environmental performance of our company



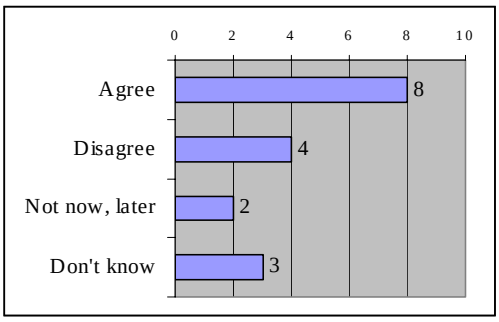
21. The local community demand improved environmental performance of our company



22. Public regulation demands improved environmental performance of our company



23. Our mother/holding company demands improved environmental performance of our company



24. To our company, the most important driver of improved environmental performance is sound economic feasibility

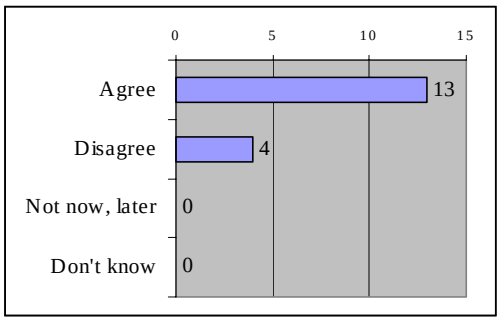
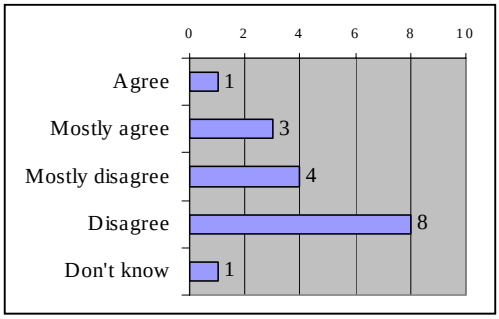


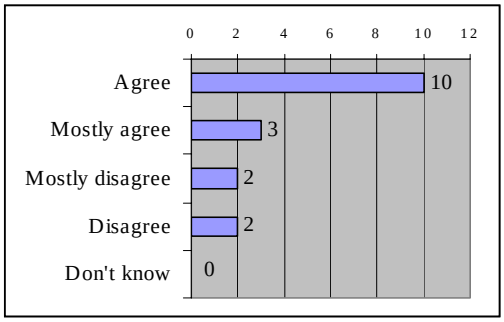
Figure 19 Drivers for improved environmental performance in the fish industry as perceived by study tour participants

Six questions (Figure 20) were designed to discover priorities for either an equipment oriented CP approach or a softer one focussing on changed work practices.

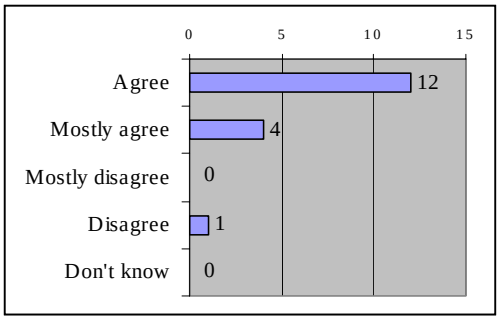
30. The most efficient way of improving the environmental impact of our company is to focus on technical issues rather than changed work practices



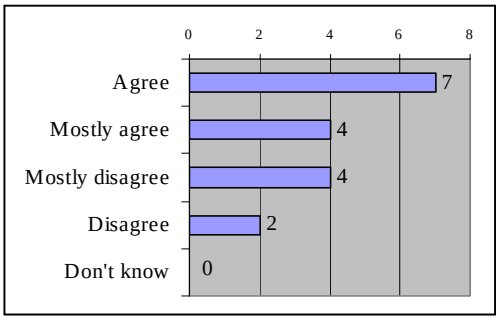
31. Changing the attitude of our workers is a major barrier for introducing better housekeeping techniques



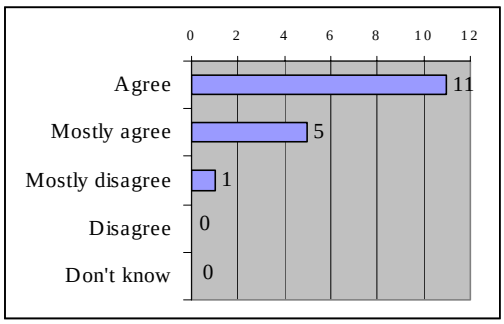
32. Our workers are the single most important asset of our company



33. The low educational skills of our workers (illiteracy etc), makes it very difficult to use written procedures in our production



34. Our workers could contribute with many valuable suggestions on how to reduce the environmental impact of our company



35. I would label the relationship between workers and management as adversarial rather than co-operative at our company

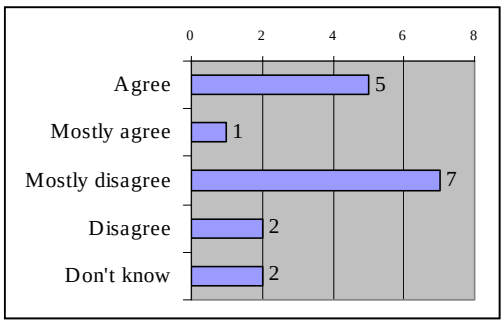


Figure 20 Views on relationships between workers and environmental performance in the fish industry amongst study tour participants

The majority believed that better house keeping was an efficient way to improve the environmental performance but more than three fourths reckoned that workers' attitudes are a major problem. Still, a large majority reckoned that workers are an extremely valuable asset. This is particularly remarkable bearing in mind the high number of unskilled and casualised workers in the fish processing industry.

About two-thirds agreed with the common perception that workers' low level of skills is a major problem. It is notable however, that one-third do not agree with this point of view. Still, more than 9 out of 10 of the respondents believed that workers could contribute with valuable suggestions on environmental matters. About half of the respondents did not believe that their industrial relations were of an adversarial nature. The results therefore indicate that strategies of worker involvement could be a reasonable option.

The implications for integrating OHS

After the study tour, it was clear that the implementing consultant did not share the 'equipment approach' to CP, which could be inferred from the PD. He did not view the project as linear sequence of events: of undertaking a CP audit, preparing investment proposals and making decisions on which proposals to subsidise, as specified in the CP. In the DTI concept, CP was not a linear sequence of events, but a process, in which the concept of continuous improvement played a major role. The implementing consultant was thus pursuing an immediate objective 2 strategy, an ISO 14000 certification approach. He cleverly used the subsidy element to leverage this process strategy, first by postponing the subsidy decision, and second by seeking to make it conditional on having implemented the DTI CP concept.

The implications for integrating OHS are straightforward. Suppose that a *tools* integration' measure had led to mandated OHS appraisals at certain key points during the project, for instance when the investment decisions were being made. The objective of these appraisals would be to give preference to investments proposals, which addressed twin problems and to oppose investments, which would cause a deterioration of OHS.

However, if the implementing consultant pursued the DTI concept successfully, this OHS appraisal activity would take place too late. It would have missed the phase of the project where most of the action would take place -- where most of the implementing consultant's attention, and perhaps also the companies' attention, would be directed.

For an effective integration to take place OHS issues would have to be integrated in the management methodology embedded in the DTI approach. As the main CP driver was improved cost-efficiency, a sincere integration of OHS into CP would likely be most successful if a similar type of incentive structure regarding OHS could be identified. This topic will be dealt with in the next Chapter 7.

Evidence of Rational Choice or Garbage Can processes during project planning?

In the following sections some of the planning efforts, as they are presented in the PD, are examined in more detail. Two competing views of the planning efforts are then presented[67]. The first view relates to a Rational Choice (or LFA) description of the planning process. In this view the planning process should be understood as a top down sequence of logically connected events. The process starts with a detailed examination of the problem, then systematically examines various alternatives after which the most optimal alternative is chosen. The process is characterised by unambiguous problems, stringent conceptual logic and a linear sequencing of events -- problems come before solutions, and solutions come before means.

The competing view presented here is that of the Garbage Can. In this view problems are ill-defined and ambiguous. The connection between problems and solutions is not necessarily characterised by conceptual logic but more by temporal proximity. Solutions may actively look for problems to attach themselves to, perhaps in order to justify their existence. The process is not linear or characterised by stringent logic but by choice opportunities, access to decision arenas, and lack of time and attention on the part of decision-makers.

The problem analysis -- what is the problem?

The PD identifies two industrial sectors as eligible for support: The white fish sector (fresh or frozen fillets) in which two dominant companies account for 75 percent of that sector's activities, and the fish canning sector in which seven companies are active. The immediate target group likely to benefit from this project is thus quite narrow, comprising only 9 companies.

As mentioned earlier, the problem analysis in the PD identifies four groups of general environmental problems: 1) smell and poor visual environment, 2) marine pollution of coastal waters, 3) resource use of water, fish and energy, and 4) health and safety in the workplace including hygiene (Danced 1998:2-3).

At face value, these problems appear simple, clearly defined and reasonable -- and probably omnipresent in any fish processing industry. However, in the later sections of the PD this orderly set of problems gives way to a more messy picture of the general environmental problems. For instance, the first general problem regarding smell and poor visual environment have "only recently" become a problem as the remote areas where many of the fishing factories are located are now being developed for tourism. They are "essentially aesthetic in nature" and represent one of the main driving forces behind the negative public image of the fishing industry

[67] For a more detailed description of competing theories on planning, see Chapter 4, in particular pages 61 and onwards

(ibid:2-3). It is notable however, that problems with smell are mostly related to the fishmeal sector, which is not eligible for support[68], and which the project therefore cannot address.

Regarding the second general problem, marine pollution, the extent of the problem is "difficult to judge". Even after years of research the "evidence in inconclusive" (ibid:2-3). Representatives from the fish industry pointed out to me that the two coast lines to the Indian and the Atlantic Ocean have 'high kinetic energy' characteristics indicative of a large dilution and absorption capacity. The situation may however be different if the fish industry is located in a bay. Studies on marine pollution in Saldanha Bay indicated that "whilst gross effects were confined to an area adjacent to the major fish factories (within 200 m of the outfall) the data did suggest a broader impact" (ibid:2-2).

The PD continues: "the relative contribution of the fishing industry, other pollutors and natural events are not known. What is clear is that the fishing industry lowers the natural absorption capacity of the receiving waters and that, any reduction in the pollution load would have a beneficial effect. *This must remain the main justification of the project* combined with the fact that the [cleaner production] approach promises a *process of continuous improvements."* (ibid:2-4 emphasis added).

This section is interesting because it reckons that while the evidence on environmental marine pollution is inconclusive it remains the main justification of the project. Marine Pollution thereby becomes the main problem. The "promise of continuos improvements" also plays a role, presumably because the process of introducing CP into the South African fish industry appears to be in a stalemate and the Danced CP project could add momentum and bring it out of the deadlock.

The PD identifies earlier attempts to launch cleaner production like initiatives. It also notes that there is a significant amount of local technical expertise. An early study from Binnie and Partners dating back to 1986 gives "advice on how to minimise pollution; to recover valuable products from the waste streams and, in particular, to conserve all sources of water so as to reduce the waste-water volume as well as to *check pollution at source*" (ibid:2-2, emphasis added). And furthermore: "The general level of awareness of the importance of the environmental problems is high. The local technical knowledge of cleaner production technologies is also impressive. Nevertheless *this has not been reflected in the workings at the factory level*. There may be a number of reasons for this related to the long term establishment of working practice norms, lack of investment capital,

[68] Structural problems prevail in the fishmeal industry related to outdated technology, production over-capacity, and low profitability. In the opinion of the planning consultant, the problems of this sector cannot be solved by introduction of cleaner production. More radical measures, e.g. rationalisation, have to be considered (Danced 1998:2-3).

uncertainty in future quotas and markets and lack of environmental legislation and consumer pressure." (ibid:2-4, emphasis added).

The concept of cleaner production is thus not breaking new ground within the South African fish industry but the industry does not appear to have given it sincere attention so far. A complex set of barriers is hinted at: lack (or lack of will) of investment capital, a focus on short term projects due to uncertainty of future quotas, lack of legislative pressure etc. In this setting, the main problem is different, more like 'The process of promoting CP in the fish industry is in a stalemate". In an LFA tree for this alternative core problem the barriers just listed could branch out below as causes of the problem. And the lack of CI could be an effect of this core problem.

Interestingly, the last annex in the PD, the Overall Strategy Analysis, argues along similar lines of reasoning. Two potential areas for technical assistance are identified: technical assistance and management assistance (Table 9). The need is with the management issues, not technical expertise.

Table 9 Potential areas for technical assistance identified in the overall strategy analysis in the Project Document

Type of technical assistance	*Nature of the need*
Technical expertise with cleaner production in the fishing industry	This seems more limited, that first assumed, given the degree of knowledge within South Africa
Management of Cleaner Production Programmes	There is a need. There is limited experience of running cleaner production programmes and such assistance would be valuable for South Africa

Note: The overall strategy analysis in the Project Document identifies a need with management issues, not with technical expertise

Source: Danced 1998, page H-3

In a similar vein, the annex identifies a list of constraints to effective technology transfer, notably "that much the technology may not be appropriate for South Africa due to differences in the price levels of water, energy and manpower and due to regulatory and market differences" (ibid:H-4). It is interesting, that despite these pieces of analysis, the final project positions itself in a narrow equipment interpretation of CP.

Problems or solutions -- which come first?

The LFA methodology puts great emphasis on keeping problems and solutions apart, underlining that problems must not be worded as an absence of a solution. However, it is difficult to maintain this separation in practice as the following excepts from the third problem area, general wasteful use of water, fish and energy resources, will show. Within this problem area, the PD lists the following specific problems of the white fish sector:

> "The emissions of organic material in the discharged waste water are mainly caused by excessive water usage, insufficiently trained staff and lack of recognised environmental responsibility at factory management level. Inadequate or lack of water treatment system cause waste of saleable raw material to the waste water" (ibid 2-3). And furthermore: "Water saving systems are not installed at the factories and in general no appropriate equipment for reliable measurements are available at the factories" (ibid:1-3)

And, regarding the canning sector:

> "Most of the companies in the canning industry have installed a rotating screen to separate offal from water but only 2 factories have installed oil skimmers and one a DAF system. The waste water with offal is, in general, transported by means of pumps causing dilution of materials into the water. The off-loading and transport of raw materials to processing takes place with an excessive water usage. Only a few factories are using any form of water saving equipment or cleaner technologies apart from the re-use of retort water. In general, no appropriate equipment for reliable production flow measurement are in use at any of the factories" (ibid:1-3).

A parallel can thus be drawn to Rittel and Webber's (1984) so-called *wicked problems* (see page 64) where the formulation of the problem *is* the problem since every specification of the problem is also a specification of the direction in which a treatment is considered. Thus, if 'pumping of waste water with offal' is recognised as a problem then, implicitly, the specified solution is a different means of transporting, for example 'dry transport' on a band conveyor, precisely a solution suggested in two handouts from a Danish fish industry consultant[69].

Some of the PD excerpts above lists precisely the absence of specific solutions, which have been implemented in the Danish CP programme. Therefore, in these sections of the project document both problems and solutions are identified *a priori* and the focus is narrowly on technology and equipment issues.

[69] The handout: 'Green & clean technology. For increased profit in the seafood industry' (Matcon, undated) and an article by two Matcon consultants: 'More food, less waste in seafood processing' (Andersen and Jespersen 1995)

Indicators -- the tail that wags the LFA dog?

The LFA immediate objective level 1 output indicator was "Sustainable reduction in water usage (50 % in canning, 25 % in white fish)". The savings in water usage achieved through investments in new equipment may be labelled 'sustainable', in the sense that the water savings would be lasting. However, it is debatable whether the *process* of the South African fish industry adopting the cleaner production concept would be sustainable. That is, if the water savings would be an isolated event or if they would form part of a broader set of CP initiatives.

During conversations with the consultant who prepared the project document, i.e. the consultant in the *planning phase*, he said that a narrow focus on equipment issues was not his first intention with the project. Rather, he felt that organisational issues should play a prominent role, in particular introducing the concept of continuous improvement. This was a major reason behind the mentioning of continuous improvement as part of the project justification (page 130) and behind the wording of the Immediate Objective 2 output indicator "Sustainable ISO 14001 certification".

However, in his perception there was a pressure from Danced to formulate objectives and outputs in a narrow and quantifiable manner. As discussed in the next section of the NAO evaluation of Danced, this would be a logical consequence of the LFA objectives oriented planning tool and consistent with the need for un-debatable means of *ex-post* verification, if the project successfully was able to achieve its objectives. It is true that it is difficult to define unambiguous objectives and specific outputs for a *process*, the ISO 14000 certification is probably the best one available.

In a Rational Choice account, the selection of suitable indicators would happen after activities had been decided upon. It would not be the reverse order, that indicators dictate activities, which again define the objectives. This leads to the second point, that the LFA is not a value neutral tool that simply helps to maintain project focus and ensure logical consistency. Rather, this particular application of LFA offers the potential to distort the project aims. It has become the tail that wags the dog.

Garbage can processes in play?

There is no single-true-narrative of the environmental situation in the South African fish industry. For the sake of argument, let me present an alternative narrative, admittedly on some accounts a speculative one, to contrast the one in the LFA.

At face value, the South African fish industry is well established, well organised, commercially viable, and, despite some fluctuations, appears to be in a financially stable and at least not unsound condition. High levels of technical competence are available, both within the

individual factories and within the sector, in the form of a research institute. Knowledge of cleaner production alternatives has been available from 1986, if not earlier. However, the CP concept has never gained enough momentum to sustain itself. There have been a complex set of barriers from perceived lack of enforcement of legislation, quota uncertainties, a cautious investment policy, perhaps a wait-and-see managerial attitude, and, recently, exceptional quota uncertainties arising from the post-apartheid transition. Low utility prices, primarily of water, may play a role as well.

The situation in the Danish fish industry one or two decades ago would, by and large, fit this description. Again, at face value, it therefore appears plausible that Danish cleaner production experiences could be applicable and valuable; that the Danish assistance could bring new life to an existing but dormant process and nudge it over some initial barriers, in particular regarding industry scepticism and myth busting. Case examples of successful and financially feasible applications of cleaner production principles could probably also improve the general reputation of cleaner production although the effects are difficult to predict and to quantify.

In this setting, Denmark (Danced) has a solution and South Africa appears to have a problem, suitable to that solution. The industry is well-organised and with considerable technical knowledge, i.e. an attractive partner. This is a choice opportunity project with a low risk of implementation failure. In this account, the solution precedes the problem.

However, the LFA planning exercise masks this situation and turns it upside down. First, there are no unambiguous output indicators for 'promoting the cleaner production concept'. Instead, indicators for project success focus narrowly on easily quantifiable water savings.

Second, although it is acknowledged that better housekeeping and improved shop floor practices are important elements, it is recognised such issues are “harder to implement” -- and from a donor view point presumably also more difficult to monitor and verify. Therefore, the focus turns to a narrow equipment and technology centred interpretation.

Third, the hierarchy of project objectives, the hallmark of rational planning, appears to be forced upon the project rather than having facilitated the problem definition. The wording of the development objective is notable in this respect, bringing compliance with "international standards" onto the scene, despite that such standards are not mentioned elsewhere in the PD and probably do not exist.

Fourth, marine pollution is identified as the major problem. As argued earlier, the emphasis on marine pollution is debatable due to the alleged high-kinetic energy characteristics of the Ocean coastlines[70].

In this alternative narrative, the solutions are not carefully thought out responses to unambiguous problems as would bee expected in the Rational Choice version. Rather the solution seems to have actively sought out a problem in order to attach itself to it and justify its existence. The project design procedure has worked backwards in order to legitimatise the solution. This is more in line to what would be expected from a Garbage Can model point of view.

Above all, however, the study of this project left me with a feeling that Danced has indicated to the planning consultant that the project must conform to a specific paradigm in order to be palatable. In particular, the project must attain results, which are *quick*, *visible*, and *objectively verifiable*. A management approach does not meet any of these requirements, but an equipment approach, with a specific focus on water savings, does. As noted in the section on indicators above (page 133) the planning consultant at one instance lamented the pressure from Danced for highly quantifiable and verifiable indicators. However, during a later conversation, when I specifically inquired for any pressures from Danced, he declined to comment in more detail.

The question is, why would Danced have an interest in pursuing results that are quick, visible, and objectively verifiable -- I will seek to shed some light on that issue in the next section on the evaluation carried out by NAO.

The political context and the 1999 NAO report

Introduction to Danish environmental assistance: the Rio summit and the EDRF

In order unfold the background for the evaluation study undertaken by the National Accounting Office (in Danish: Rigsrevisionen), henceforth NAO, the background for Danish environmental assistance will briefly be reviewed.

Development assistance has for decades been a part of the official Danish foreign policy. The policy expenditure target has been one percent of the GNI. That assistance has been administered Danida organised under the Danish Ministry of Foreign Affairs. *Environmental* assistance has been a priority of some of Danida's development assistance projects but seldom as stand-alone environmental projects and generally only to the extent that

[70] At worst, the environmental effects mentioned in the development objective are strictly local, not regional, and certainly not global. At the extreme, the marine pollution impact of the South African fish industries may be more comparable to the fish industry of Greenland or the Faeroe Islands, which also discharge effluents into large water bodies.

environmental aspects would fit in under the overall Danida policy of poverty alleviation.

The 1992 UN conference on Environment and Development in Rio de Janeiro, Brazil, changed this picture. The Rio declaration outlined a number of principles, among others that environmental assistance must form an integral part of development policy and that all countries should have shared, but diverse responsibility for solving global environmental and developmental problems. In response to this, Denmark set up the Environment and Disaster Relief Facility, henceforth EDRF, in 1993. This facility included resources for a number of different purposes: environmental assistance to Eastern Europe and the Arctic, efforts as part of global environmental programmes and aid in connection with e.g. assistance granted to refugees. The relative distribution of EDRF funds to the various purposes is shown in Figure 21.

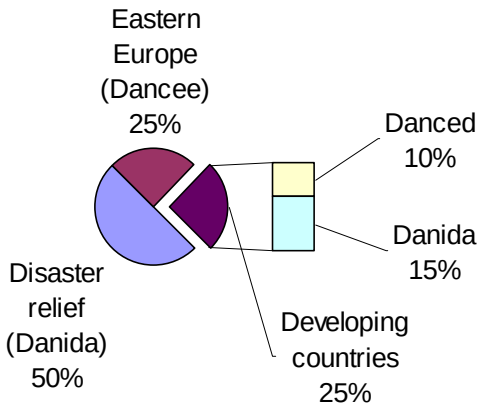


Figure 21 Distribution of EDRF funds (percent)

Half of the funds go to disaster relief administered by Danida. The other half to environmental assistance, of which the part to developing countries is administered jointly by Danida and Danced

Source: Danida and Danced, 1997

Funding to the facility was to be ramped-up over period of about 10 years with a final expenditure target of 0.5 percent of the GNI in the year 2002. The EDRF expenditure is independent and additional to the development assistance expenditure under Danida, already amounting to one percent of the GNI.

Environmental assistance within the EDRF framework is jointly administered by Danida and Danced (Figure 21). Danced came into existence in 1993. Whereas Danida is organised under the Ministry of

Foreign Affairs, Danced is organised under the Ministry of Environment and Energy. The division of labour is such that Danida oversees assistance to the poorest countries while Danced oversees assistance to the more developed countries[71]. (Danida and Danced, 1998)

Why divide EDRF administration between Danced and Danida?

There are at least three official reasons for why environmental assistance under the EDRF was organised under two different administrative agencies.

The first reason concerns the different nature of environmental problems in the countries for which EDRF funds were destined. In middle income developing countries such as Malaysia, Thailand and South Africa, environmental problems are closely related to industrial and economic development. In less developed countries, however, like Vietnam and Malawi, they are associated with the depletion of natural resources, such as deforestation, which are intricately connected with general poverty problems. The causes of the environmental problems and the level of administrative capacity of the government bodies in the two groups of countries would be expected to be of a different nature and thus call for different type of assistance activities.

Second, a division would follow the lines of competencies in the two ministries. Expertise with regard to industrial pollution was located in Ministry of Environment and Energy while expertise with poverty alleviation and land use was located in Danida

Third, the Ministry of Environment and Energy was already active in some environmental assistance projects in Eastern European countries, which were similar in nature to the EDRF middle income developing countries. Likewise, was Danida already active with projects in the poorer countries focussing on poverty problems. It would therefore be a natural continuation of existing activities if the Ministry of Environment and Energy would organise assistance to the more developed countries, and the Ministry of Foreign Affairs (Danida) to the less developed. (NAO 1999:4,16,37,51)

There is, however, circumstantial evidence that other less official and more political reasons played a part in organising EDRF assistance

[71] The scope of the EDRF (in Danish: Miljø- og katastroferammen, MIKA) was broadened in 1999 and the name changed to the Environment, Peace, and Stability Facility, EPSF, (in Danish: Miljø-, Freds- og Stabilitetsrammen). This report is concerned primarily with the events leading to the initiation of environmental assistance and will consequently refer to the original name, EDRF. A new system for national accounting, (ENS95) introduced as part of a European Union harmonisation drive was implemented in Denmark in 1997 resulting in a technical increase in the Danish BNI. The expenditure target of 0.5 percent of BNI was therefore delayed to the year 2005 (NAO 1999:42, 91)

under the two different bodies. In 1992 the Danish coalition government since 1982 led by the conservative Prime Minister Schlüter was defeated by a coalition government led by the social democrat Nyrup Rasmussen, who became Prime Minister. The minister of foreign affairs under the conservative government, Mr. Ellemann-Jensen, was a highly charismatic person and the ministry had under his leadership become increasingly powerful. It has been suggested to me that the new government could have felt that the ministry of foreign affairs had become too powerful. In the first coalition government under Prime Minister Nyrup Rasmussen the ministry of foreign affairs was broken up in three competence areas: foreign policy issues, development issues and the Baltic countries, each with its own minister! The minister for Baltic affairs was a short-lived construction, but to date (2001) there are two ministers in the ministry of foreign affairs, a minister for development (Danida) and a minister for foreign policy. If the purpose of this break-up was to reduce the relative power of the ministry of foreign affairs, the argument goes, there would be little political will to locate EDRF and the administration of another 0.5 percent of GNI with that ministry.

Second, the social democrat party were led by Mr. Auken during the years of opposition in the 1980s. In a painful power struggle between two factions in the social democrat party, however, Mr. Auken was narrowly defeated by Mr. Nyrup Rasmussen at a party congress in 1992. The dethroned Auken, a highly capable and charismatic person and the most obvious rival to Mr. Nyrup Rasmussen, then became minister of environment and energy in 1992. A possible reason for creating Danced under the auspices of the ministry of environment and energy is that it is part of a take-and-give affair, a concession given by Mr. Nyrup's winning faction to Mr. Auken's loosing faction[72].

Structural considerations (ministerial power) as well internal party squabble (political) could therefore offer alternative explanations for why the newly formed EDRF assistance was located with two different public bodies. It could also hint at potential barriers to the smooth co-operation between the two agencies.

The reason presenting this alternative view is the simple hypothesis, that the behaviour of an organisation should not only be understood from the official policy and strategy documents but also from the political context in which it operates. It therefore positions the administration of EDRF funds in an alternative context of struggle for power and influence between two ministries. I will argue that understanding this context is a necessary precondition for understanding the type of projects Danced can engage in. I will argue that the political context determines the type and content of environmental assistance projects Danced will engage in.

[72] That such check-and-balances deals have been struck between the two rivalling factions in the social democratic party is discussed, for instance, in WA 20011123.

Background and mandate for the NAO report

The National Audit Office is an independent institution set out to ensure democratic control with public expenditure. Its main task is to audit the state accounts and to examine whether state funds are administered as Parliament intended. It can carry out a wide range of control activities, among others performance audits in order to examine whether institutions have spent state appropriations in a sound financial manner taking into consideration economy, efficiency and effectiveness. The NAO may also examine whether the activities of the institutions comply with the objectives. In principle, everybody can suggest that the NAO examines a particular subject, however, only the Parliament's Public Accounts Committee (PAC) may request that the Office examines certain matters.

In April 1998, the PAC requested NAO to review the environmental assistance activities, which were financed by the EDRF. In effect, that would be a comparative evaluation of the activities carried out by Danced and Danida. The PAC request took the form of a number of specific questions, inter alia regarding (NAO 1999:42):

- impact - if the effect of the assistance continued after projects were completed (lasting effects)

- organisational issues - if there were any particular conditions in favour of this type of development assistance being managed solely by Danida, solely by Danced, or if the present organisational division between the two agencies was the most expedient

- co-ordination - if the two agencies collaborated in relevant matters

- administrative capability - if Danida was capable of administrating (the new type of) environmental assistance projects, and if (the new organisation) Danced was capable of administrating the expected increase in funds for environmental assistance

As such, the NAO study appears not only as a benign comparative evaluation of the two agencies, Danida and Danced. The mandate of the study explicitly questions if the division of labour between the two is expedient. For Danida a potentially unpleasant conclusion could be that all activities should be organised under the other agency, leaving Danida with the traditional development assistance activities only. For Danced however, a potentially unpleasant conclusion would be that the organisation would cease to exist under the auspices of the ministry of environment and energy.

NAO evaluates from a paradigm of strategic planning

The NAO combined the resolution of these questions with a general assessment of the two agencies' administration of funds earmarked for environmental development assistance. The assessment focussed on (NAO 1999:43)

- the overall strategy and its ability to give structure and direction to the programme (the control of aims)
- the transformation of this overall strategy into operational regional strategies and country programmes
- the planning of the country programme contents, in particular with respect to prioritisation and selection of specific projects
- follow-up monitoring and review activities, in particular of the extent to which the support activities have had the intended effects.

It is thus clear that a major concern of the NAO is the overall logical consistency and coherency of the environmental assistance programme. This is particularly evident in the following statement "The NAO has investigated if objectives at the overall level have been clearly and adequately specified and if these objectives in turn have been adequately operationalised through the hierarchy of strategies and plans" (ibid:59). This 'hierarchy of strategies and plans' clearly draws from the paradigm of strategic planning with its hierarchy of strategies, tactics, plans and activities.

In the case of activities, in South Africa, four major 'areas of activity' have been defined in the regional programme: urban environmental management, pollution control and waste management, sustainable energy, and natural resource management. (Danida and Danced 1999:65) NAO criticises the lack of direction and operationalisation expressed in these four areas of activity, which constitutes "an insufficient basis for planning" at the country level. Country programmes should be formulated in a manner, which specifies the intended results. The NAO furthermore recommends that criteria for prioritisation of support activities be developed which include the 'utility-value' of the Danish support. (NAO 1999:63)

Measurability and accountability are cherished values

The NAO also recommended that "country programmes shall include quantifiable goals, which in part will assure coherence in the [environmental] assistance and in part permit a subsequent evaluation if the support produced the desired effects. Such goals could be e.g. a specification of the desired level of environmental expertise and administrative capacity within a particular area, or a measurable reduction of a particular environmental problem, and the impact of the Danish support on this problem." (ibid:65).

Interestingly, both Danced and Danida objected to the impracticability of this approach. Danida observed, that the definition of detailed quantifiable goals *at the country programme level* would presuppose that all the individual projects in that country had been examined and listed in the programming phase, which the ministry felt was 'obviously impossible' (ibid: 62). In other words, Danida argued that the NAO recommendation was a logical contradiction.

On the other hand, Danced argued that such indicators, while perhaps desirable, do not exist for certain types of projects. A number of Danced projects had been aimed at increasing the administrative capacity of the public agencies dealing with strategy formation and other regulatory tasks. For example assistance with the development of new environmental legislation such as the policy strategy paper "White paper on integrated pollution and waste management for South Africa" (DEAT 2000). For such projects, Danced objected, specific and quantifiable result indicators of the type requested by the NAO are not available at present. Danced furthermore objected that other issues also had to be considered and that planning at the country level never could be based on simple effect criteria alone.

Danced had for this reason together with the World Bank embarked on a collaborative project "to develop indicators for capacity development within the environmental field, [with the purpose] to show, if a positive or negative development of human capacity and capability has taken place." (ibid:66). The NAO report recommended that "this work should have high priority" (ibid:74).

The immediate purpose of such indicators is to measure and describe the effect of support given. Another obvious purpose of such indicators is to resolve conflicting assessments of project impacts on a more objective basis. One such conflict is evident in a capacity development project in Thailand's Pollution Control Department, which was supported by Danced. An external consulting company carried out a favourable evaluation of the project and it was generally identified as a highly successful one. The NAO subsequently paid a visit to the Thai Department and interviewed an executive, who the NAO found to have "no particular knowledge of the project". Additionally, that he "demonstrated ignorance with respect to the series of seminars and workshops that had taken place during the project" (NAO 1999:110). In other similar projects evaluated by the NAO, there were also difficulties with retaining staff in the public institutions, partly due to salary differences between the public and the private sector. In one project, about one third of the seminar and course participants were no longer with the Department, half a year after project completion. The NAO therefore concluded, that the lasting effects of this project may be put in doubt (ibid:136).

The NAO concluding remarks

In its concluding section (ibid:150), the NAO evaluation report observes that

- the experiences so far have not confirmed the need for both Danced and Danida to undertake the administration of environmental development assistance activities

- Danida possesses the necessary competence to carry out environmental development assistance (but, interestingly, a similar statement cannot be found for Danced)

- the costs of administration of the two agencies are similar (i.e. that the one organisation is not more administrative cost-efficient than the other one, thereby refuting a Danced assertion that this organisation is more 'lean'), and

- that the collaboration between the two agencies in general should be intensified.

The NAO evaluation report, forwarded to parliament, is thus voicing substantial criticism of the desirability and expediency of the present division of labour between Danida and Danced questioning among others if the new organisation Danced has the necessary competence to fulfil its obligations. In its summary statements the NAO expresses a general discontent with development assistance observing that "... a number of factors entail risks that the projects will not have lasting effects. This is however, *neither in scope nor in nature essentially different from other developments projects* in the developing countries." (ibid:38, emphasis added)

Various opposition political parties on the right wing are highly critical of development assistance activities. Danced officials with whom I spoke felt that the evaluation was a political manoeuvre orchestrated by the right wing opposition to discredit and harass Danced.

I will not go any further into the intricacies of NAO evaluation studies and the political play in ordering such evaluations to be carried out. Suffice to say, that the NAO study is indicative of a situation of which there is no broad political consensus about carrying out environmental assistance project and in particular about having an separate organisation (Danced) under the auspices of the ministry of environment and energy. The general political support for Danced can thus be described as, at best, unclear, at worst, hostile.

How will an organisation act in the framework of accountability to NAO

I will hypothesise that a situation of unclear political support will affect the behaviour of the Danced organisation in the following ways.

First, there will be a tendency to follow formal rules, to 'go by the book' in order to shield itself from possible criticism from the NAO and the opposition.

Second, a tendency to define objectives narrowly and a preference for objectives, for which measurable and verifiable indicators exist, rather than for objectives, for which softer means of verification are available, i.e. to prioritise rigour over relevance.

Third, possibly a tendency for risk aversion, to set objectives with caution -- only those that can reasonably be attained.

With these hypotheses in mind I will proceed with last case study of a Danced CP project, in which I followed the project planning and preparation phase.

The metal finishing CP project

General characteristics of the metal finishing sector

Metal finishing operations are employed at some point during the manufacturing of essentially all metal products. They are intended to modify the surface properties, for example increase corrosion or abrasion resistance, alter appearance, add hardness, add specific electrical properties, or alter the product in some other way. Metal finishing cover a potentially vast number of operations, in which metals are cleaned, prepared, treated and coated. A wide range of processes are in use, for example galvanising, electroplating, anodising, painting, and coating. Many are batch operations in which the articles are dipped into and then removed from baths containing molten metals or chemical reagents. Typically, objects are moved through a series of baths.

The toxic nature of many of the chemicals involved means that the sector is highly relevant to target, both from an environmental as well as occupational health and safety point of view. There are many 'twin-problems' of which problems in the external and the internal environment have the same underlying cause: the use of a toxic substance in the production process. Many of the coat metals are toxic and some of the processes involve extremely toxic chemicals, for example concentrated cyanide solutions, a potent poison. Some of the metals and chemicals are both acutely poisonous and have long term toxic effects of a cumulative nature.

There are essentially two types of operations. In-line shops perform metal finishing operations on items that they manufacture themselves. Job-shops (or jobbing shops) are separate entities that do not manufacture parts, they provide metal finishing operations for products manufactured elsewhere.

Particularly in the electroplating industry there are a number of very simple, low-cost, and highly effective CP options. They typically involve improved drainage of items in order to reduce drag-over of chemicals from one bath into the next bath. They also typically involve improved rinsing, for instance achieved if one large rinse tank is spilt into two or more smaller tanks, which run in counter flow. With these simple techniques it is "usually quite easy" to reduce rinse water consumption by "at least 50 percent and, in some instances, by as much as 90%" (UNEP 1989:14).

Allowing sufficient dripping time for treated work pieces is the simplest and most cost-efficient method of pollution control. Three simple low cost methods are shown in Figure 22. The drip time may simply be increased as in a), or a drip collection tray may be installed as in b), that allows the fluid to be taken back to the bath. In c) a sloping drain board takes drip fluids back to the tank. Such methods are described in, for instance, EPA (1996), UNEP (1989), and UNEP (1998)

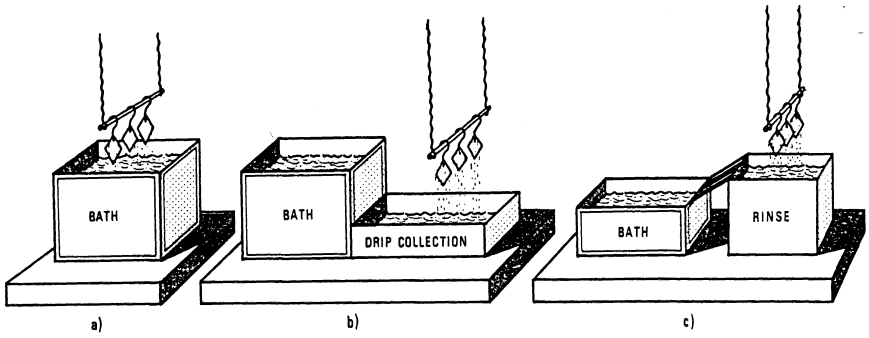


Figure 22 Three simple CP techniques in the electroplating industry to reduce carry-over of chemicals from one bath to the next

Source: UNEP (1989:13)

Not all CP options are so simple of course. In some cases, the entire process must be changed in order to deal with a specific problem, for instance shifting from cyanide zinc plating process to a non-cyanide alkaline process. However, very substantial improvements are within reach employing simple methods.

The initial problem analysis

Danced subcontracted the job of designing the CP intervention and prepare a PD to a consultant, henceforth the planning consultant.

I joined him in a number of his activities, factory visits, meetings with industry representatives, service providers etc.

The South African metal finishing industry is diverse and geographically widespread. At a relatively early stage it was therefore necessary to limit the scope of the project to two industrial sectors in order to maintain focus: It was decided to focus on the two industries of hot-dip galvanising and electroplating. They were the most promising industrial sectors "where measurable improvements can be made in terms of cleaner production within limited timeframes and budgets" (Danced 1999:1).

The hot-dip galvanising industry comprises around 30 companies, which are relatively easy to identify. The process involves submerging the items in a bath of molten zinc. A significant capital outlay is required to start a hot-dip galvanising business, around R 2.5m, and this tends to deter non-serious investors from entering the business. The economic environment is relatively good with the market growing at 6 percent a year.

The companies are represented by the Hot Dip Galvanising Association (HDGA), which has nearly 100% membership coverage. The HDGA holds office in a Johannesburg suburb where it maintain a small but well run organisation comprising a few support staff and a director. The organisation has been quite active in promoting the interests of its members and in helping to stimulate awareness of new opportunities for its members. It has, for instance, liased with private specialist consultants in order to deal with a significant waste problem of spent concentrated acid. In conjunction with the specialists, a new recovery process was devised and a central facility in Johannesburg built. On commercial terms, acid waste is now collected and taken to the central treatment facility after which the recovered acid is resold to the industry.

In stark contrast, the precise number of electroplating companies is shrouded in uncertainty but is estimated at about 500. Electroplating companies come in almost all sizes, but the majority fall within the category of small and medium companies; i.e. with between 5 and 100 staff. More than 50% of the companies are located in the Johannesburg area, with the bulk of the remainder spread mainly in the Cape Town and Durban areas.

Electro-plating is an easy business to get into. Many of the processes are relatively simple, require limited capital outlay, and only modest technical knowledge. Thus, the number of operators is considerably higher and the standards of business performance vary greatly from one company to another. A number of small companies are active, some with only a few employees and operating from interim facilities, so-called back-yard operations. The regulatory authorities may either be unaware of the existence of some of the small companies or of the activities they undertake. The serious players are those with a long-

term business mission and they probably represent around 25 percent or more of the total number of known companies. The remainder are driven by short-term profit motives and plan only on a short-term basis. Operators in the electroplating companies describe the domestic market as saturated and expect that the number of companies will decline as competition forces some of the more inefficient companies out of business.

The industry is also highly disorganised. There is a branch of the American Electroplating Surface Finishers (AESF) but membership is small and declining. The head of the AESF estimated that less than 20% of the electroplating companies in South Africa were with the association. He lamented that many electroplating companies did not see any benefits in joining an organisation. The fierce competitive situation created adversarial conditions within the sector and companies tended to view each other solely as competitors, not as potential partners for any sort of collaboration. Nor were there any interests in meeting the authorities (environmental or other) as a unified industry. Individual business owners felt that they would be better off with a 'duck and dive' strategy, which they had pursued so far.

The head of the AESF expressed interest in the CP project, most likely as a means to bring new life to the association. He felt that it would be beneficial if the strong ties with the American association could be broken and a purely South African association could be established. Much of the information from the American association was not relevant in South Africa, he observed. Technology was too advanced, quality demands were stricter, the average business size was larger etc. However, he did not have the resources to form a new organisation on his own. In the view of the planning consultant, the head of the AESF was a potentially important stakeholder in a CP projects because he was one of the very few means by which a larger group of businesses in this highly fragmented industry could be addressed.

The head of the AESF was running a job-shop electroplating business of his own with about 20 employees. I went to visit him together with the planning consultant to conduct an interview. His operations, I was later to learn, was not so untypical of many jobbing shops. A small cluttered factory area was located in a relatively old building. We had to stride over piles of bags of finished and untreated goods that were stacked on the shop floor, creating an impression of disorganisation. The workplace was noisy, dirty and messy, the floor wet from spillage. Workers appeared to be of the low-wage low-skill kind. The work performed appeared to be of the high-volume, low-profitability type. The business owner complained to us about his various types of obsolete equipment. He was aware of a number of very simple CP techniques such as longer drip-off periods and more efficient rinse cycles but he could not spare the resources to modify his processes.

The in-line electroplating operations that we visited generally had superior operations to the jobbing shops. A manufacturer of door handles and locks, which also served export markets, had tidy and orderly operations. They had about two years earlier become part of an international conglomerate and their operations were quality certified according to the ISO 9000 series. Specialist advice had become available to them through the new ownership structure and they not only knew about a number of CP production techniques but had also implemented some. It could not help notice some conspicuous signs over the line of plating baths, such as "Do not wash hands or clothes in the hot soak – Disciplinary action will be taken". Company representatives told me that the company had abandoned an old practice where some workers at times during winter slept overnight in a back room where heating was available. Fortunately the practice was ended before a fire the year before broke out, which would have killed any workers staying in that back room. The same representative described worker productivity as "appalling".

The three hot-dip operations that I visited with the planning consultant gave the impression of being well organised. They generally had above 200 employees, managerial staff appeared professional and knowledgeable, and operations orderly and tidy. Fumes and splashes of molten zinc were generally stated as major problems and they had all taken some preventive measures against this. One company stood out for its upbeat enthusiasm and its emphasis on improving workers' skills. The company had a history of poor worker relations, which were close to bringing the company to halt some years before. Since, the main task had been to 'turn-around' the company into a profitable operation with lasting job opportunities. It had launched Adult Basic Education and Training (ABET) initiatives as well as education into 'life skills', which focussed on basic skills, and worker attitude and behaviour. It had also invested in several 'basic productivity improvement' projects[73].

The company visits gave illuminating insights into the situation of the two industrial sectors. It is, however, difficult to judge if the companies were truly representative for their sector. This was particularly evident for one hot-dip galvaniser, where the secretary by mistake had faxed us the driving instruction to an older facility located in a different industrial area. While we did not see much of the operations there and were quickly redirected to the intended facility, operations at the first site clearly appeared substandard to the one we were shown in detail.

[73] The company was awarded a Silver Award in the 1998 National Productivity Institute's annual competition ('Monoweld leads the field in galvanising', BR 19990611)

The cleaner production workshop in Pretoria

An important activity in the project preparation phase was a national one-day workshop on cleaner production in the metal finishing industry held in Pretoria. Participants were invited from industry, from the service providers (in particular chemical suppliers) and from the authorities. In effect, this was an LFA workshop. An extremely complex, if not messy, set of problems were evident from that workshop.

First, there is no source of formal educational route into electroplating. Many platers said that they had learned the basic skills while servicing in the army. Others had started their company with a basic knowledge of operations obtained during former employment and then learned additional skills as the need arose. Most platers relied heavily on the chemical suppliers for detailed technical knowledge of process and process chemistry and, not the least, for maintaining the chemical composition in their process baths.

Second, that industry perceived enforcement to be random and unfair. Authorities were perceived to go after 'easy targets', notably the larger and well known operators, which, in their own view, contributed relatively little to pollution -- and ignore the smaller and informal back-yard operations that were undertaken with total disregard to effluent and other standards. One plater said that he was concerned about one such 'cowboy operator down-the-street with a few tanks and no effluent plant' because poor environmental performance enabled the competitor to undercut prices.

Third, that authorities lacked the most basic resources to enforce legislation. For example, a public servant from the DEAT told me, that there were only a single digit number of air pollution inspectors in the entire country. I was later told by another public servant that while the Johannesburg environmental authorities had expensive equipment to analyse effluent streams for toxic metal compounds, they did not have the funds for the burning gas necessary to operate the equipment. As a result the expensive equipment stood idle and enforcement control activities were lax.

Fourth, that the platers viewed each other with a great deal of mistrust. A speaker from Durban, John Danks[74], who ran a jobbing electroplating business there, was invited to speak about the experiences of forming a so-called Waste Minimisation Club (WMC). The idea of the club was that business owners met on a regular basis and exchanged ideas and experiences on how to minimise emissions. He suggested that the platers in the Johannesburg area set up a similar arrangement. This suggestion was met with loud scepticism.

[74] Mr. Danks has played a pivotal role in the Durban WMC. He was invited to join a small team CP study tour to Denmark made possible by a small Danced grant. This tour had a very large impact on Mr. Danks perceptions about the benefits of cleaner production. I have conducted several interview with him which are covered in more detail in Chapter 8.

A Johannesburg plater stood up and asked why he, who had struggled for so many years to learn the tips and tricks of the trade, should give away this information to competitors. Mr. Danks repeatedly told them that the Durban platers, and, indeed, himself as well, had had the same initial reservations when starting the Durban club, but that there was much valuable advice to be shared, which did not have an effect on the competitive situation. If he felt that any information was sensitive, he would not share it, he said. Still, his WMC suggestions met with no sympathy from the Johannesburg platers.

The workshop ended with a voting exercise. The participants were given a number of colour-coded adhesive round labels (votes) with which they could mark a list of pre-worded options. The options fell within the three categories of barriers, drivers and support options. A participant had four votes within each category, which could be cast with no restrictions. If a business owner, for instance, felt that lack of finance was the crucial problem within the 'barriers' category, he could chose to cast all four votes on that single problem. The options were phrased during the workshop based on the opinions expressed during discussions. The colour-coding scheme was green for industry, blue for regulators, red for service providers, and yellow for 'others'.

The results from the voting exercise are presented below. They are sorted according to the number of votes from industry, the target group for the CP project. Regarding barriers to CP (Figure 23) some of the answers were both predictable and amusing. For instance that the majority of business owners felt that inconsistent enforcement of legislation was a major barrier, while only few legislators felt so. Likewise, that the majority of legislators felt that low prices of water and raw materials were a major barrier, while hardly any business owners voted for that option.

Business owners generally identified barriers of lack of knowledge on CP options, lack of finance to implement them, and lack of compelling reasons to do something about it, either due to inconsistent or lax enforcement or due to unclear standards (customer requirements). Interestingly, few business owners felt that lack of time or working traditions were significant barriers. Legislators identified lack of knowledge as major barriers, both in terms of lack of knowledge on CP options and on the industry's detrimental effect on the environment. The voting pattern of the service providers (chemical suppliers) is particularly interesting as they provide the perhaps most unbiased and informed view on the issue. They identify lack of knowledge, lack of pressure and then lack of finance as the predominant barriers to the implementation of CP.

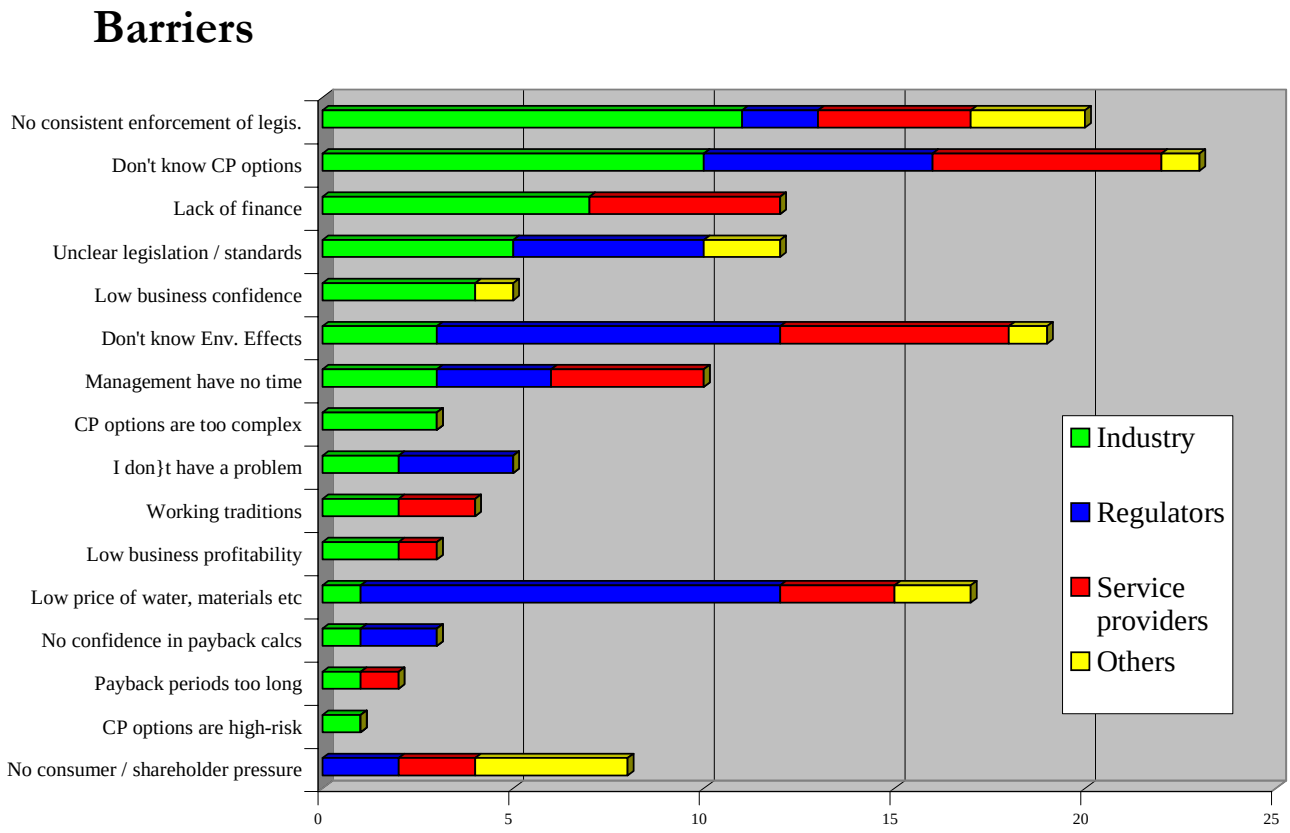


Figure 23 Voting results from the workshop: Barriers against introducing cleaner production in the metal finishing industry

Regarding drivers (Figure 24) there was general agreement amongst the workshop participants that the major driver to CP was cost savings. Service providers identified effective enforcement of legislation as the second most important driver. Interestingly, few of the business owners and none of the (environmental) regulators felt that linking OHS issues with CP would be a significant driver.

Concerning the last category, support options (Figure 25) there was consistent agreement amongst the workshop participants that training of the shop floor workers was the principal means of support. An idea catalogue of CP techniques ranked high amongst business owners. Waste minimisation clubs were prioritised mainly by regulators and service providers but still ranked third amongst business owners. Only regulators felt that an overseas study tour would be of much benefit. Interestingly, there was very little support from business owners to subsidies to CP audits.

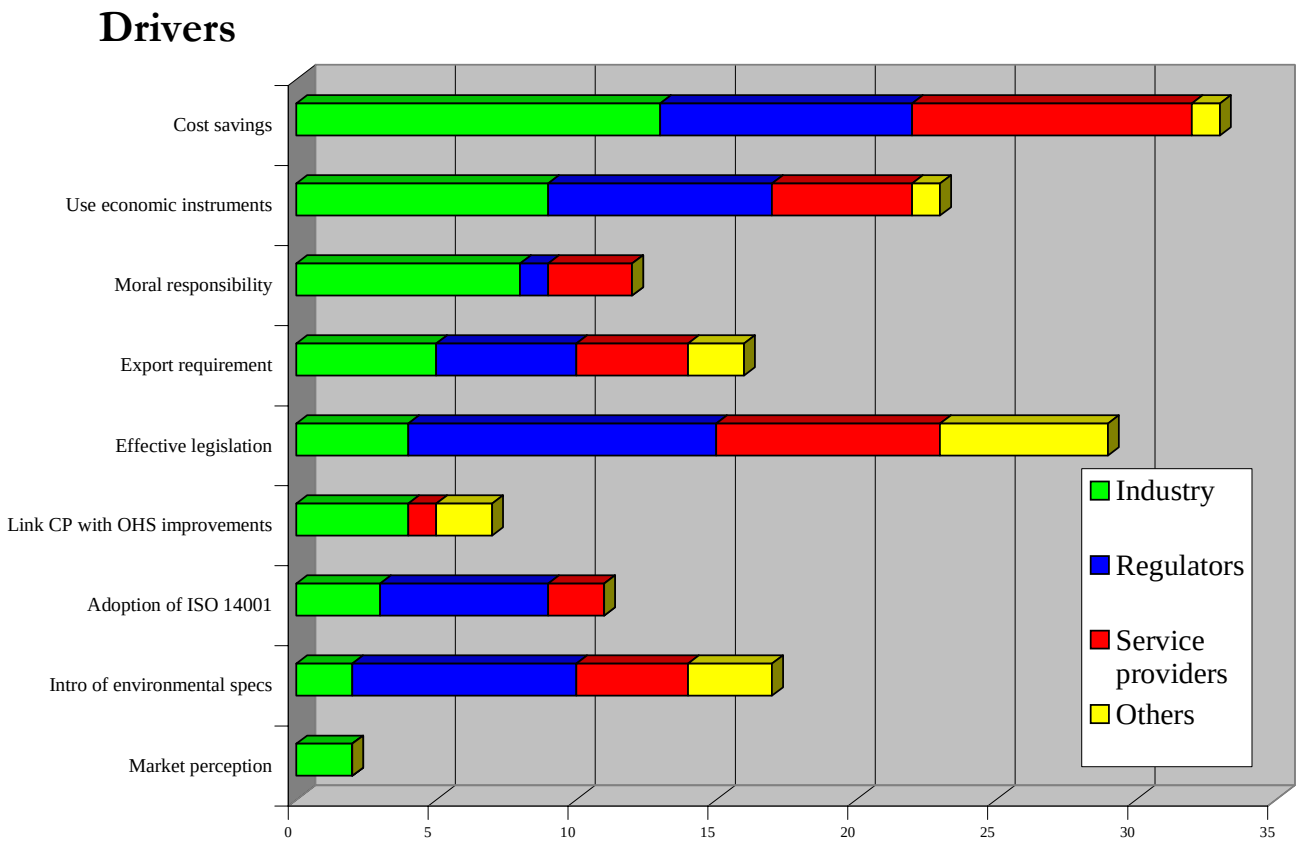


Figure 24 Voting results from the workshop: Drivers for introducing cleaner production in the metal finishing industry

It is laden with difficulties to extract firm conclusions from such a workshop. Various actors have been given the opportunity to present their divergent views on a complex situation but any kind of consensus on what the major problems are (here worded as barriers) is hard to identify.

There is also the question if the actors are representative. This is especially true for the electroplaters -- how many small business owners attend environmental workshops anyway? The situation is also complicated by the uncommitting nature of the workshop arrangement -- it is possible, while perhaps not likely, that none of the workshop participants will eventually take part in the CP project. Stakeholders are ill defined and their participation in the planning process is fluid.

Logical inconsistencies in the voting patterns can also be identified, for instance that the massive voting for the support option 'Shop floor training' is not matched by a similar strong voting pattern for the barrier 'Working traditions'.

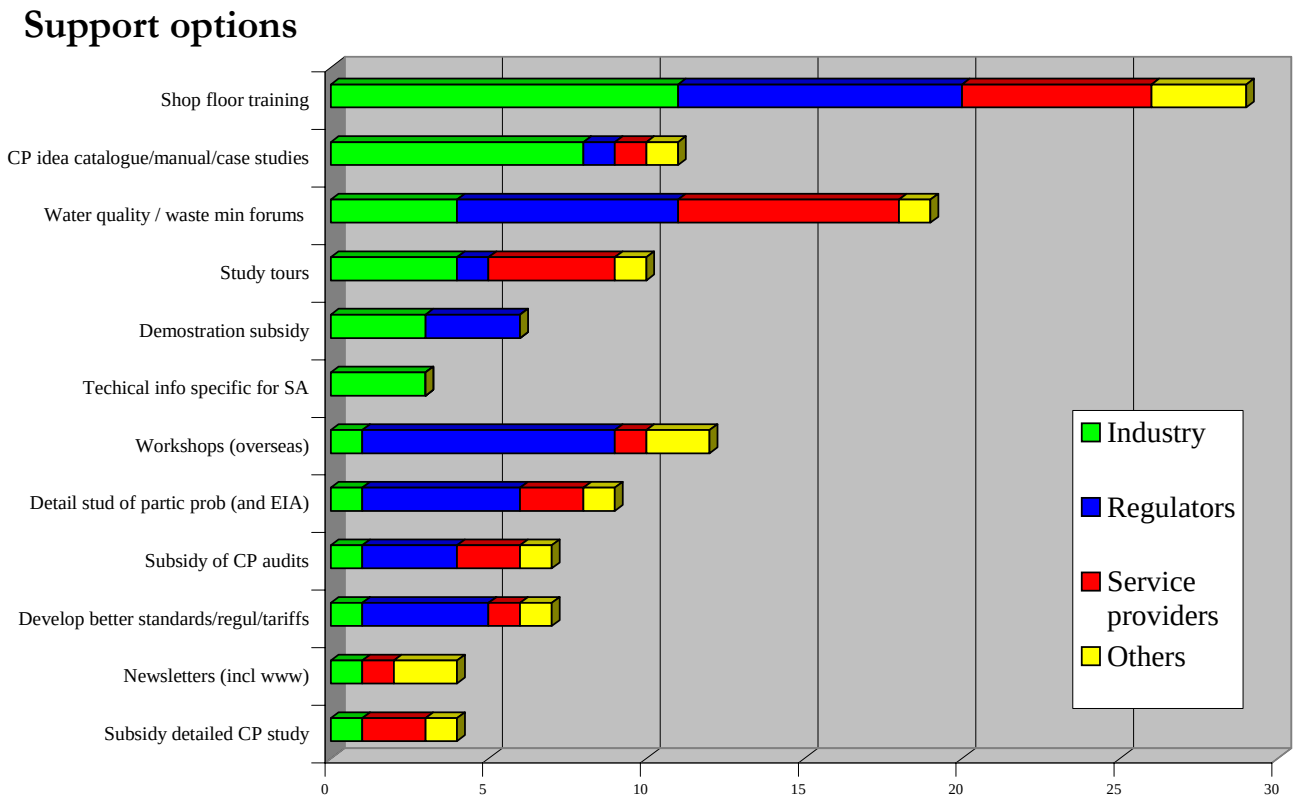


Figure 25 Voting results from the workshop: Support options to help introduce cleaner production in the metal finishing industry

Concluding remarks on the workshop exercise

Despite the difficulties and inconsistencies, the voting patterns revealed that while the workshop participants had divergent opinions about the underlying problems there was more general agreement about preferences for drivers and support options.. The top-score barrier only attracted 23 votes, less than the 33 votes for the most popular driver, and 29 for the most popular support option. Direct numerical comparisons cannot be made. There were fewer options to choose from in the 'drivers' category, and thus less dilution of the votes. In addition, some attendees were apparently leaving the workshop during the voting procedure resulting in fewer total votes cast for support options, than for barriers. Nevertheless, the overall impression is that the major driver to be pursued is cost savings and that support should focus on employee training and the provision of knowledge, either as a 'catalogue of ideas' or as an 'experience sharing forum' of some kind.

The workshop also underscored the highly heterogeneous nature of the potential participating companies of the CP project. Many of the characteristics of the electroplating sector simply inverts those of the hot-dip galvanisers on major accounts (Table 10)

Table 10 Heterogeneous nature of the metal finishing industrial sector

	Hot-dip galvanisers	***Electroplaters (job-shops)***
Size	Large	Small
Management	Professional	Business owner
Structure	Organised	Disorganised anarchy
Economic climate	Relatively good, market is growing	Talks of crisis, market is saturated and number of companies declining
Barriers to entry	Significant, substantial capital investment required	Few, little capital outlay needed, basic technology is relatively easy

Many of the characteristics of the hot-dip galvanising companies simply invert those of the electroplating companies

Each of these characteristics of the electroplaters constitutes a major challenge to a CP project, indeed to any project targeted at this industrial sector.

Is Danced really interested in OHS?

I had briefed the planning consultant on the purpose of my study. It was my impression that he perceived me as one of many actors on the playing field, as a representative of a special interest group, of the 'academic OHS establishment'. As such he invited me, as he did with other interest groups, to forward suggestions on which elements I would like to see in the project. What should the project do to improve the occupational health and safety of the metal finishing industry? -- I was asked.

The planning consultant was experienced, conscientious and observant of the rules of the game in an agent-principal (consulting) arrangement. During the course of the project preparation he currently tried to keep the local Danced office informed of developments, also trying to find out what their expectations and preferences to the project were. As such, I am convinced that he had secured some sort of

consent with Danced before taking me with him to the company visits -- ensuring that OHS issues indeed were legitimate project objectives. Still, at times he appeared perplexed about Danced's genuine commitment to OHS.

As mentioned earlier (page 32) I also joined some of the activities in preparing the textile CP project. A senior representative from the Danish EPA joined in on some visits to cotton production facilities. While travelling to one of those facilities we also discussed OHS and CP projects. The senior representative expressed reservations if OHS should be a legitimate separate project objective. There were other highly important issues, she argued, which were not being addressed specifically -- above all energy consumption; a truly global environmental problem. So why should OHS claim a right for special treatment when other urgent issues of global importance were not given so?

Danced offices are not overstaffed and it is not easy to get access to decision-makers. Meetings are planned in advance, tend to be short, held in a business like atmosphere, and the representative generally appears visibly constricted in respect of time, eager to move on to the next meeting. On one such occasion a Danced representative told us, in a slightly derogatory intonation, that the project, of course, should not address standard OHS issues like accidents, injuries and so on. Danced had a clear preference for interventions which were proactive and visionary. I was left with the impression that OHS interventions were not generally believed possess these qualities.

I my opinion, the planning consultant captured the Danced concerns quite precisely in this passage from the PD: "there is a risk that this [OHS] might become a main focus for companies rather than a measurable spin-off benefit of cleaner production. Such an emphasis may place the focus onto *protecting* workers against present dangers rather than seeking to *remove* the dangers" (Danced 1999:27 emphasis added). I believe that the passage captures the situation in a nutshell.

First, for a number of companies the comprehension of environmental 'problems' or 'responsibilities' may be vague and diffuse. Environmental issues may easily loose ground to problems within the OHS domain in which the target group is clearly defined, highly visible, and indeed, OHS issues may be a shadow battlefield for other conflicts lurking beneath the surface concerning power and control. In this setting short term protective measures may drive out long term preventive measures in a kind of Gresham's Law equivalent[75]. In this context the issue is a genuine risk. For example, I spoke to a young self-employed consultant[76] in Port Elizabeth who worked with ISO 14000 environmental management systems (EMS) in industry, one of

[75] From the field of economics, Gresham's law states that: Bad money drives out good money. People tend to spend to cheapest form of currency that sellers will accept, saving better money for other uses.

[76] Interview with Rob Gardiner, Moorhouse Consulting June 9, 1999

the very few consultants in this field that I came across in South Africa. He told me that he strode to keep OHS issues out of his EMS projects. OHS issues kept surfacing "all the time" and were an impediment because he could not keep his project focussed on the topic of his contractual obligation with the company.

Second, while it represents a risk, it at the same time also represents an opportunity, if the interest for OHS issues could be directed into strengthening the environmental cause -- in particular what concerns 'twin-problems'. The planning consultant identified this issue in earlier sections of the PD.

Third, that Danced officials are torn between their desire to be visionary and innovative and at the same time to stay within the envelope defined by the rational efficiency discourse of visible and measurable results achieved in short timeframes for limited budgets. Danced is on a mission to fight global environmental problems in order to secure our common future. They are on a mission to save the world, nothing less. In this global perspective, the wellbeing of a few workers will inevitably be an issue of inferior importance. Whilst they desire to spread the revolutionary concept of cleaner production and environmental responsibility, the rationality discourse forces them to focus on measurable water savings, and in the fish project, contradictorily to alleviate a strictly local environmental problem.

Introducing OHS into the Project Document

As was argued in an earlier section concerning the fish industry CP project it was imperative that OHS be addressed in the PD. If not, the implementing consultant would have little clue that OHS was a legitimate project objective.

I therefore sought to introduce OHS considerations wherever relevant in the PD. In particular I felt that OHS should be integrated into the LFA matrix, identifying OHS issues as part of the objectives, the outputs, the indicators etc. The main line of reasoning was that specific OHS agendas should not be pursued in the project. Rather should opportunities be exploited to address issues where problems within OHS and environmental issues coincided. However, for this objective to succeed OHS issues had to be visible, it had to remove any doubts that OHS was indeed one of several legitimate project objectives. This section will shortly review the outcome of these efforts.

The planning consultant noted that the lack of an OHS baseline situation was a major barrier against OHS issues to be considered at the indicator level in the LFA. If the baseline was not known, how should the indicator be able to objectively verify if a project objective was attained, he questioned. I had no immediate answer to that.

There are two major reasons that it is more difficult to quantify OHS performance than it is to quantify environmental performance. The first one concerns mostly practical reasons. Many environmental key figures are already registered somewhere in a company, in the accounting system, in the emission control scheme arrangement entered into with the authorities. Many environmental indicators can therefore be obtained simply by mining data from existing sources elsewhere in the company. This is not so for OHS indicator for which measurement programmes for instance regarding noise or chemical exposure in many cases will have to be established from scratch.

Second, figures on accidents and injuries, which are the most widely used indicators for OHS performance, are essentially reactive. They are not proactive and can only play a small role in a preventive program. There are furthermore many methodological problems in establishing trustworthy accident and injury incidence data. The topic is discussed in more detail in Chapter 7, in particular on page 180 on onwards.

For these reasons, most of the indicators would have to be of the soft type, rather than of the objectively verifiable type.

Finally, OHS was integrated in the Project Document in the following manner. The first reference to OHS is in the executive summary, which states that both internal and external environmental issues will be addressed in the project. Basic documentary analysis reveals that OHS issues are mentioned in relation to other issues at 31 other occasions throughout the PD (Danced 1999). Visibility and legitimacy issues should thereby be reasonably addressed.

In the section 'objective analysis', the PD identifies twin-problems as relevant for OHS interventions. The PD states that the project "will need to address both the external and internal environment. The internal environment is best addressed when improvements of a preventative nature have a dual impact on the internal and external environment. At the very least the project should not result in a worsening of the internal environment. There is also a lot to be gained from using internal environment as the starting point for upgrading worker and supervision skills as part of improved housekeeping and cleaner production practices" (Danced 1999:18). It is to the credit of the planning consultant that OHS issues are linked with changed shop-floor practices and improved housekeeping, mainly through upgrading of *skills*, a very timely topic in the contemporary South African debate.

OHS issues were then incorporated in the development and the immediate objective LFA level. At the development objective level OHS is mentioned in the text, but not directly at the indicator level, as seen in Table 11.

Table 11 Incorporation of OHS issues in the LFA development objective level

Development objective	*Indicators*
A significant reduction in the environmental impact of the South African metal industry, within the electroplating and galvanising sub-sectors, largely due to a preventative approach."	The project has a focus on the electroplating and galvanising sub-sectors. The Project has both quantitative and qualitative aims. Water, energy and chemical savings and reduced effluent pollution can be measured and monitored. Increased environmental awareness (a changed mind set) which will ensure project sustainability and replicability is more complicated to monitor within the project period. An integrated approach to internal and external environment should be pursued Overall Objective level indicator: Pollution reduced and environmental performance from the electroplating and galvanising companies improved.

Source: Danced (1999:29) underline emphasis added

The incorporation of OHS issues at the immediate objective level is shown in Table 12 overleaf.

Table 12 Incorporation of OHS issues in the LFA immediate objective levels 1, 2 and 3

Immediate objectives	*Indicators*
Immediate Objective 1 1. Cleaner production processes and practices implemented in the Metal Finishing companies, within the electroplating and galvanising sub-sectors, with sustainable results.	a) An indicator of success is the reduction in overall water, energy and chemical usage (in the order of 20% as an average for the involved parties) and an equivalent reduction of pollution load in the related emissions. Improvements to the working environment should have taken place. Brief reports on these figures from involved companies will be included in documentation material from the demonstration projects as routine. b) An absence of interventions that have a negative effect on the working environment
Immediate Objective 2 Sustainable and accessible capacity within the sector to further implement and develop cleaner production processes and practices.	The achievement of objectives 2 and 3 can be monitored by more soft indicators such as: c) the number of participants in study tours and the percentage of metal finishing companies and others going on study tours. (both in South Africa and Denmark). d) the number of company employees taking the various CP training and awareness courses. The development of training in each of the CP tools and techniques over time e) the number of CP trainers educated. A formal exam and issuing of diplomas in the various CP tools should be considered and the number of trainers passing these exams accounted for. Development of the CP training capacity over time expressed as capacity within each of the CP tools and techniques f) the number of company-supplier matches and company-company matches made and the development over time g) the number of demonstration projects carried out and the development over time h) the adoption and uptake of demonstration technology in factories as a result of the demonstration investments in other factories and the development over time. i) The percentage of audits that mention or take consideration of the internal environment issues. j) The degree to which companies have responded to and made use of working environment training courses and information. k) The percentage of demonstration projects that have led to improvements in the internal environment. l) questionnaires to monitor the CP awareness and attitudes of metal finishing companies can be developed and used at each of the periodic seminars throughout the project as well as at the end of the project period to follow development in awareness m) the establishment and membership development of waste minimisation clubs n) The number of changes to specifications made
Immediate Objective 3 Increased awareness amongst regulators and the electroplating and galvanising sub-sectors of Metal Finishing industry sector in particular on the current negative environmental impacts of the sector and the possibilities and opportunities to mitigate these impacts through the introduction of cleaner production processes and practices	

Source: Danced (1999:29-30) underline emphasis added

The project strategy

The general project strategy approach took the same form as in the fish CP project with a phased implementation of four components: training, assessments and actions plans, physical investments, and, dissemination and monitoring[77]. The approach is essentially similar to that in the fish CP project.

Implementation of the project was laid with the HDGA, which would house the project management group. The HDGA staff is very small and the project would therefore support the association on with the funding of a full-time project secretary and a part-time project co-ordinator for the duration of the project. While it would be extremely important to have the AESF on board, it was (rightfully, in my opinion) judged that this was simply not feasible. As the PD observes: "The Electroplaters association [AESF] is too fragmented at present to provide much support – reliance is therefore placed on the HDGA" (Danced 1999:41).

Any potential conflicts of interest between the two association were largely downplayed. The PD says that: "In order for the project to be placed as close as possible to the two industrial sub-sectors in focus, it will be located at the offices of the Hot Dip Galvanizing Association (HDGA) in Johannesburg. The project will work in very close collaboration with the American Association of Electro-plating Surface Finishers, and then its successor once the re-organization of the AESF is completed. The two associations enjoy very close working relationships and this is found to be the most convenient and practical way to ensure smooth communication with both sub-sectors through a single agency." (Danced 1999:44)

It is doubtful if his arrangement will work as intended in practice, resulting in the two agencies working in 'very close collaboration'. The AESF shows clear signs of dysfunction, being run in the spare time of a small business owner who has so many other pressing priorities to attend to. However, it is entirely understandable in the framework laid out by Danced where CP projects must involve an industry association -- a requirement set up in order to raise the chances for successful knowledge transfer and dissemination, i.e. a guard against implementation failure.

It is true, though, that the requirement also tends to exclude the needy (in this case the electroplating companies) and channel support to the well organised and, perhaps, less needy companies.

[77] For instance as reflected in Danced 1999, figure 4-1 p. 35

Conclusion

The chapter has identified and drawn attention to some of the key criteria that characterise the framework for Danish environmental assistance. They are

- a focus on specific improvements
- with measurable and objectively verifiable indicators
- which are attainable within a short time frame
- for limited budgets

It has been argued that such criteria are a consequence of the political processes that determine parliament's support to the Danced organisation, which is a combination of a hostile political play between the opposition and the government together with an empiricist and positivist tradition within the National Audit Office. Meeting the criteria above thereby becomes a method for the Danced organisation to shield itself from possible blame.

It has been argued, that the development planning techniques, in particular the LFA, are not value neutral and benign tools that merely helps to focus the project and gently to assist in the problem analysis phase. Rather, they twist and distort the project ideas. In the fish project, the problem setting is forced into a framework of marine pollution, which may be ill conceived. The project description invites to a narrow technology focus on water saving equipment although this was not the initial intention of the planning consultant. The main quality of the focus on water savings appears to be the availability of measurable and objective indicators. This enables an objective measurement of an *ex-ante* baseline and permits an objective measurement of *ex-post* performance, and hence, permits a quantification of project impact. The main quality is thus its quantifiability (*rigour*) -- not its *relevance*.

Regarding the metal finishing industry, the disorganisation of the electroplating sector makes it difficult to target for Danced. Danced had laid down three criteria for support to cleaner production initiatives. First, that the sector must be represented by a sector organisation. Second, the sector must have a recognised service body. Third, there must be an expressed commitment by a number of individual industries within the sector[78].

The electroplating sector does clearly not meet the first criteria. Fulfilment of the second is doubtful because there is no tradition within SMSE industries to seek professional advice. Only the last criteria may be met in full. From both an environmental and OHS point of view, the electroplating sector is highly *relevant* to target. However, they do not meet the *rigorous* requirements for eligibility to receive support.

[78] Criteria are laid down in Danced (1997), repeated in Jensen et al. (1998)

On the other hand, about 30 companies are involved in hot-dip galvanising. The companies in this sector are easy to identify, the capital outlay is high, and they are all organised in the HDGA. Compared to the electroplating sector, the hot-dip galvanising sector uses a more limited set of chemicals and those chemicals are generally less environmentally problematic. There are, for example, no processes involving cadmium, cyanide, nickel etc. The hot-dip galvanising sector may therefore be less *relevant* to target, but they meet the *rigorous* requirements laid down for support.

This chapter has argued that unclear broad political support and rivalry with Danida entails that Danced adheres stringently to systematic planning tools. Additionally, that Danced prefers projects with visible, measurable and objectively verifiable result indicators that are attainable within a short time frames for limited budgets. The resulting emphasis on *rigour* leads the projects to sacrifice on *relevance*. The chapter argues that this may constitute a special problem for the introduction of OHS issues, because of a shortage of easily available, quantifiable and, not the least, objective OHS indicators.

The following conditions for integration OHS into CP projects have been identified in this chapter. First, that OHS issues must feature in the Project Document (PD), that is, integration at the *structures* level in the terminology introduced in Chapter 3. If the PD is silent on occupational health and safety issues, this can only be interpreted by the implementing consultant as evidence that OHS is not a legitimate project objective.

Second, that for OHS to be integrated into the PD it is necessary also to integrate OHS into the LFA planning tool, that is integration at the *tools* level

Third, this entails that proper indicators for OHS outcomes which meet the standard requirements for LFA be established. Indicators for preventive measures within the OHS domain are intrinsically difficult to define, an argument which will be examined in detail in the next chapter. Nevertheless, in the metal finishing case study an attempt was made to introduce proactive OHS indicators in the metal finishing PD

Fourth, that any ambiguity regarding if OHS is a legitimate Danced objective must be ruled out. OHS must appear more prominently in Danced's strategy papers, and in particular in the Terms of Reference (TOR) that starts the process of planning a new project

Chapter 7. The management system study

Introduction

The previous chapter outlined how the implementing consultant from the Danish consultancy DTI intended to introduce cleaner production in the South African fishing industry. The approach was, in keyword form: pursue environmental management systems (EMS), adopt the Deming plan-do-check-act management circle, and motivate from economic cost-efficiency considerations. That approach sets the stage for this chapter because attempts to integrate occupational health and safety (OHS) into cleaner production (CP) projects at the level of methodology (*tools* integration) would have to bear on a similar type of approach.

This chapter is devoted to an examination of the question if a similar approach could be employed within the OHS domain.

The chapter will explore two major themes. The first theme concerns the *effectiveness* of systematic and preventive activities within the OHS domain. The chapter will start with a review of early systematic approaches to accident prevention, which slowly took shape from about 1910 and onwards. It will be argued that there is a remarkable similarity between those early approaches to accident prevention and present day approaches to environmental management. However, sort of a paradox exists. While the approach is considered successful (effective) within the environmental domain, its application within the OHS domain has allegedly been a failure. *This paradox bears further examination*, because if true, there would be little prospect for integration of OHS and CP at the level of methodology. The first theme therefore concerns effectiveness of preventive OHS approaches -- seeking to answer the question: Do they improve firm's OHS performance?

The second theme concerns the ability to *measure* the quality of preventive efforts within the OHS domain. It will be argued that traditional measures of OHS are principally inadequate because they are reactive measures of failure, dealing only with undesired outcomes in terms of injury or illness. They provide little, if any, guidance to the activities which firms could undertake to prevent those undesired

outcomes. The discussion of the second theme therefore seeks to answer the question: Can we find upstream indicators of the processes that determine these outcomes, so-called proactive OHS indicators, that are *auditable* and *certifiable*? As the later discussion will show, earlier studies afford, at best, only guarded optimism in this respect.

Answers to these two questions have relevance beyond this study's immediate research question of how to integrate OHS in Danced's cleaner production projects. Companies increasingly address OHS issues in formal management systems, typically as an add-on to ISO series management schemes, or as stand-alone British Standards Institute OHS management schemes (OHSAS 18001), and others[79]. The question regarding effectiveness is crucial to the adoption of such systems. Should it be true that they have no effect within the OHS domain, as some authors have suggested, there would be no reason for companies to embark on them. Should the systems be effective, the question if companies' proactive efforts are auditable and certifiable is extremely relevant to ISO-type schemes.

This chapter attempts to shed some light on these two themes. First, the findings of earlier studies reported in the international literature are discussed. Surprisingly few studies have been undertaken, and the empirical basis of those studies is limited. The chapter then moves on to discuss the empirical work undertaken as part of the present study: a hypotheses testing comparative study evaluating the South African Nosa 5-Star OHS management system. The empirical work, upon which this hypothesis testing activity is based, is, in terms of time spent, the major empirical activity of this Ph.D. study.

The paradox, as it unfolded

Objective - integration at the level of methodology

A section in the previous chapter (see page 121) outlined how the consultant from DTI (a Danish consultancy) intended to implement the cleaner production projects in South African fishing industry. The summary characteristics of the DTI approach are,

1. the major driver is economic cost-efficiency, epitomised in 'pollution prevention pays'

2. important milestones in the process are defined by the timely production of written documentation, in particular the production 1) of an environmental report, 2) of a policy document, 3) of exact

[79] Typically, OHS issues could be implemented in existing ISO 9000 series quality management schemes or new ISO 14000 series environmental management schemes. The British Standards Institute originally published a nonauditable standard (BS 8800) for an OHS management system, now available in an auditable version, Occupational Health and Safety Assessment Series, OHSAS 18001. Mansdorf (2000), Hopkinson (2000), see also the proposed standard by ILO OHS-MS (2001)

environmental objectives, 4) of written responsibilities and work procedures, and 5) a manual.

3. the approach is systematic, formal, and control is exercised though hierarchic and bureaucratic rule. The approach is of a top-down type, starting with management commitment and orders are assumed to cascade down through the organisational hierarchy in an autocratic manner

4. the process is championed by an expert, who is usually located in a staff company position

5. there is little involvement of the employees at the shop floor. Many activities are focussed towards improving established work practices. The workers are requested to be co-operative, but they are generally not asked for their advice or suggestions in this process

The least intrusive manner of integrating OHS into a CP project would be to introduce OHS issues directly into this framework, mimicking each of its characteristics. That is, integration at the tools or methodology level in the terminology of Chapter 3. The rationale behind this strategy hinges on the assumption that if either of the major characteristics of CP were challenged, for instance departing from cost-efficiency being the major driver, integration would be felt more disruptive and consequently would be less likely to succeed.

Visits to fish processing industries

As I visited some of the fish processing industries that were partaking in Danced's CP project, it came to my attention that several companies already had some sort of systematic approach to occupational health and safety in place. This was typically witnessed by a board above the company entrance indicating that the company had a safety 'Star rating' of sorts. For instance, a white fish company that I visited displayed such a board. I spoke to the Occupational Health and Safety Manager[80] who told me that the company was rated by CRM (Corporate Risk Management), a consultancy that was associated with the insurance firm of the fish company. He was in charge of the company's safety program, which covered many typical insurance risks, for example fire, motor vehicles and security; but the safety program also comprised occupational safety elements. The CRM audited the quality of the company's safety program and rated their efforts according to a scale from zero Stars (no program in place) to five Stars (flawless implementation of program). The OHS manager had earlier been employed with the factory inspectorate. He identified major problems as small cuts and bruises, slips, trips, in particular on stairs, knock body parts against hard objects etc. The (temporary) flexiworkers were particularly vulnerable, not so much the permanent

[80] Interview with Occupational Health And Safety Manager Frank Hickley, Sea Harvest, June 10, 1999

staff, he said. He battled to raise the safety awareness of people through small group activity, safety committees, 'info-com' forums where workers were involved in communication, but lamented that the safety committees did not contribute much, they did not "exercise their rights", he said. Unions were mostly concerned with salary, in what in he attributed to be the result of a "mindset". Yet, this was understandable, he said, since many workers were "under the bread-line", hardly able to support their families.

He ran safety campaigns and used training materials from the National Occupational Safety Association (Nosa) of which he spoke very positively. A similar positive view of Nosa was also conveyed to me from another interviewee[81], the person responsible for safety at a fish canning factory. He told me that Nosa was a key provider of safety information, in part through courses and training materials, in part through their systematic and programmatic approach to OHS issues embodied in their proprietary 5-Star safety system. Although the fish canning company was not audited by Nosa at that time, they used significant elements of the Nosa 5-Star system. Consequently, they had been able to reduce their injury rate by a factor three, I was told.

The paradox

However, as I went further into the subject of 5-Star occupational health and safety management systems, I was truly intrigued by the contradictory nature of the evidence and assertions that were presented to me. On the one hand, various industry representatives and safety professionals painted a positive picture of the 5-Star system's capabilities and the remarkable improvements in workplace safety, which it could bring about. This positive view was, by and large, mirrored by academics at the University of Pretoria and at the University of Port Elizabeth, with whom I spoke. On the other hand, a senior medical doctor at the National Centre for Occupational Health in Johannesburg told me, with eyes flaming of indignation, that they found people "dying from asbestosis inside the gates of 5-Star companies". Furthermore, workers' unions were highly distrustful of the Nosa system, as were academics within the field of industrial relations at the University of the Witwatersrand in Johannesburg, with whom I spoke.

From the workplace visits that I had undertaken, I had a general feeling that Star rated workplaces had a better occupational health and safety performance that those, which were not. Star-rated workplaces were clearly more orderly and tidy, machinery appeared to be guarded, workers wore proper clothing etc. In contrast, non Star-rated companies appeared more disorganised and unsafe situations could more easily be identified, for instance a worker moving jigs from one plating bath to another, involving aggressive chemicals, without proper clothing.

[81] Interview with Reduction Plant Manager Driko Maritz, St Helena Bay Fishing Industries, June 11, 1999

In summary, a paradox of sorts unfolded. I had identified a major South African player actively promoting a systematic approach to OHS prevention. One the one hand, companies, safety professionals, former factory inspectors, and some academics, praised this 5-Star approach for its ability to improve workplace health and safety. On the other hand, occupational physicians, industrial relations academics, workers unions, and, as it would turn out, papers in major international scientific journals, were either highly distrustful or voiced a devastating critique of 5-Star systems. In short, the critics claimed that 5-Star systems were a sham, unable to improve workplace safety.

The paradox could not be ignored. The Nosa 5-Star system appeared highly relevant to my study in at least six respects. First, that it allegedly represented a proactive and systematic approach to OHS, i.e. an view on prevention similar to CP. Second, that it claimed to measure the quality of those proactive OHS efforts, holding promise of a number of sub-indicators which could find use as possible LFA proactive indicators. Third, that implementation appeared to be of the top-down variety employing bureaucratic and hierarchic rule, similar to the CP approach championed by DTI. Fourth, that the program had evolved in the face of high costs associated with accidents, i.e. a clear cost-efficiency driver similar to the CP approach. Fifth, that Nosa management contemplated to expand the scope of the 5-Star system also to include environmental management, i.e. a similar agenda of integration as my own, but from a different starting point.

And last, but not least, that the methodology in the 5-Star approach largely mimicked that of CP. The 5-Star approach claimed to be risk analysis driven, starting with the identification of an inventory of OHS priorities, then setting priorities, intervening, and followed by an audit to check if the intervention had the intended effect. This is essentially the plan-do-check-act (PDCA) circle in use in total quality management (TQM), on which the DTI approach to CP was based (see Figure 14 on page 118).

One possible strategy of integrating OHS issues into a CP project would be to integrate at the level of methodology, i.e. addressing OHS issues at company level in a similar PDCA manner as environmental issues are addressed. In Denmark, this type of integration was apparently emerging spontaneously. In one survey, about half of the companies that implemented environmental management systems also included occupational health and safety in their management system (Christensen et al. 1997:23).

However, the critique of the 5-Star system would imply that this type of integration would be futile. It would be meaningless to explore the avenues of integrating CP and OHS from the point of view of integration at the level of methodology.

The following hypothesis therefore slowly took shape: A top-down management approach to occupational health and safety within a predominantly cost-efficiency discourse, such as the one by Nosa, is largely ineffective in improving the occupational health and safety performance of companies. Should this hypothesis be true there would be very little reason to embark on a methodology-level integration strategy in the Danced CP projects.

The Nosa system

The history of Nosa

A South African government commission in 1948 investigated means of reducing workplace accidents, which it saw as a source of unnecessary human suffering and inefficient waste of manpower, materials and time. This led to the establishment in 1951 of the National Occupational and Safety Association (Nosa) as a not-for-profit organisation. It was set up as a joint venture between the Workmen's Compensation Commissioner (WCC) and employers' associations and funded extensively by the State Accident Fund. The overall purpose was to strengthen South African knowledge on occupational safety expertise.

From a company perspective, the commission viewed accident prevention as a financially cost-effective activity that will reduce waste of resources and lower the contribution to the workmen's compensation system. The commission therefore viewed accident prevention as a management responsibility. Hence the inclusion of employers' associations on the Nosa board and the use of economic arguments to promote accident prevention.

Nosa has over the years been a major actor on the OHS scene is South Africa. It has developed a broad range of training courses offered to industry. It has developed a curriculum for its own people, which was eventually taken over by the Department of National Education and so established the National Diploma in Safety Management. It publishes two monthly safety magazines. It organises an annual 3-day Noshcon safety conference, which serves as a focal point for safety professionals. Nosa has thus exerted considerable influence over health and safety education and training. (Dekker 1990, 1996). Public funding has gradually been reduced and the organisation now (2000) generates most of its own income through courses, seminars, and other services.

Nosa has since the 1970s developed a 5-Star Safety Management System with the dual purposes of 1) directing companies' accident prevention activities, and 2) offering recognition of the extent to which excellence in safety management has been attained. The 5-Star system is offered to companies on a completely voluntary basis. At the time of the empirical study (2000) companies could purchase the system documentation, checklists and other written guidelines at a nominal

fee. Should a company desire a Star-rating, auditing consultants were available at standard commercial rates. Nosa would also provide a range of OHS training courses at standard commercial terms, should the company so desire. The companies' motivation in the scheme is presupposedly 1) the cost-efficiency of preventive safety activities, and 2) the prestige and goodwill associated with a high Star-rating.

Fundamentals of the Nosa 5-Star system

Nosa has formulated 10 axioms or self-evident statements of occupational health and safety onto which their safety approach is based. Some are (Dekker 1990:68)

- The occurrence of an injury or damage to property invariably results from a completed sequence of factors -- the last one of these being the cost itself. The accident in turn is invariably caused or permitted directly by the unsafe act of a person and / or mechanical or physical hazard.

- For every accident causing serious injury there are numerous occurrences which cause property damage and / or business interruption

- Management has the best opportunity or means to initiate the work of prevention; therefore it should assume the responsibility of setting a Management by Objectives system in operation.

The Nosa 5-Star system comprises a Star rating audit procedure for assessing the quality of a company's accident prevention program. "A one star grading would indicate that a rather weak accident prevention programme is in operation whereas a five star grading would indicate that it is one of the safest factories in the country" (Dekker 1990:70).

Two numerical criteria determine the Stars score. The first involves scoring of management's efforts to reach the safety objectives, the so-called *effort* leg. The second criterion is derived from the lost time injury frequency rate of the company, the so-called the *experience* leg. The experience criterion is determined from the company's so-called disabling incidence frequency rate (DIFR). A 'disabling incident' (DI) is defined as one which disables the worker from working one day, or longer. Finally, the effort score and the accident experience are combined to determine the Star rating according to criteria defined in Table 13.

A typical audit lasts two days and involves a team of two auditors. An audit team normally comprises a safety expert and an occupational health practitioner. The first day of the audit is usually spent reviewing the elements of the safety management system. Specific studies on OHS issues that have been undertaken at the site, for instance regarding ventilation, lighting, hazardous chemical substances (HCS), noise, fire, etc, are reviewed. The auditors follow up on

recommendations of those studies to reveal if they have been implemented. Auditors also carry out spot checks of the system's written procedures and controls. This is essentially an audit of the paper trail of the safety management system.

Table 13 Criteria for awarding Nosa Stars[82]

Star category	Effort (%)		Experience (DIFR)
5 Star – excellent	≥ 91	and	≤ 1
4 Star – very good	≥ 75	and	≤ 2
3 Star – good	≥ 61	and	≤ 3
2 Star – average	≥ 51	and	≤ 4
1 Star – fair	≥ 40	and	≤ 5

Effort -- management system point score, based on a system audit and field inspections -- percentage of maximum points possible.

DIFR -- disabling incident frequency rate - the number of lost time (1+ days) accidents per 200,000 hours worked.

Note: There is an additional Noscar category -- essentially a sixth Star, see footnote 82 on this page.

Source: Audit Workbook, Nosa 1998

A substantial part of the second day is usually devoted to a detailed field inspection of the safety practices in use. Both the system audit and the field inspection are guided by long checklists. As the auditors encounter deficiencies in the management system or discrepancies during the field inspection, they deduct points from the relevant checklist item according to specific auditor guidelines. At the end of the second day the total point score of the company is divided by the maximum points possible to produce the *effort* score.

[82] Note regarding NOSCAR Star-ratings: Somewhat misleadingly, there is an additional top Star bracket, the so-called Noscar category, which for practical reasons can be considered a 'sixth Star' in the 'five-Star' system. Rules are complex and have recently (2000) been modified. In short, only 5-Star companies that have a very high effort score of 95+, and no fatal injuries, are eligible to enter a regional contest the coming year where they will be audited by a specially selected team of Nosa auditors. The winner of the regional contest is awarded the Noscar recognition. If awarded, the Noscar status can be retained for consecutive years, conditional that Noscar contest eligibility criteria remain fulfilled. Whenever eligibility criteria are violated the Noscar recognition is lost and the company must win a new regional competition to regain it (Source: Nosa internal document MR05, appendix 1, rev 01, copy obtained Jan 25, 2000, and personal communication with Nosa auditors)

The 5-Star system originated in the 1970s as a comprehensive checklist (programmatic approach) but has over the time undergone a series of revisions. The 1998 version, which was in effect at the time of this study, appears as a combination of a checklist and a risk analysis approach. The system's checklist items specify a number of areas that must be attended to, but the actual activities are to a large extent risk driven, that is, the priorities as based on company specific conditions and not from a rigid check-list approach. A few select examples from the Audit Workbook (Nosa 1998) will illustrate the workings of the system:

Section 2.00 Mechanical, electrical and personal safeguarding

Element 2.17 Hazardous chemical substances (HCS) control

Component 2.17.1 Record of all HCS

2.17.1.a Risk analysis conducted on all HCS and record of all substances including by-products and waste from the manufacturing process available

2.17.1.b Inventory of raw materials and all intermediate mixtures available to OHS

Items for consideration under this component are: How is the system managed to meet standards with regard to: 1) identification and recording of all HCS, 2) risk identification, 3) identification marks/labels, 4) company and contractor transport.

The examples illustrate the Nosa 5-Star system's mix of programmatic and systems approaches. The checklist programmatic approach is evident in the large number of specific requirements structured into 5 sections, 72 elements, approximately 300 components, and more 'items for consideration'. Component 2.17.1 for instance, requires (programmatic approach) that a survey be undertaken of hazardous chemical substances. At the same time are risk analysis techniques (systems approach) employed and bureaucratic controls in use: how have risks been identified, how have they been assessed and by which criteria prioritised, which control measures have been devised to handle the risks, who is responsible, is there an auditable paper trail, etc. In this respect the 5-Star system has adopted newer systems theories, which focus on inputs, process, outputs, and feedback mechanisms.

Because of the great number of system elements and the emphasis on bureaucratic controls, companies usually have to employ a full time Safety Officer to run the Nosa system, who will usually refer to the Site Manager or the CEO.

There is a clear conceptual analogy between the safety audit activity that result in a Star-rating, and the control activities that companies are subjected to within the financial domain. The safety auditor who checks the health of the company's safety management system is

likened to the certified public accountant who checks the soundness of its financial statements. There is an analogy between a high Nosa Star-rating and a spotless endorsement of the company's income statement and balance sheet by a reputable accounting firm.

Tracing the origins of the Nosa system to the Safety First movement of the early 1900s

The Nosa system owes much intellectual debt to the Safety First movement, which evolved in the USA around 1910. The movement pioneered new techniques to accident prevention in the workplaces of the newly industrialised society in which safety was abysmal.

It was primarily the new safety practices developed in very large companies such as steel works and explosives manufacturers that laid the foundation for the Safety First movement. This led to the emergence of a wholly new engineering discipline, the safety engineer, which advocated the idea that safety was integral to good management. Safety experts encouraged this view by trying to show that safety was synonymous with efficiency and by demonstrating that accidents were more costly than had been suspected. The way to stimulate the interest of the 'big boss' was to show the correlation between safety and production.

Safer machines encouraged workers to work faster, safety engineers argued. The introduction of saw guards, it was reported, increased output. The redesign of the punch press was a dramatic example of how safety also raised worker output. August Kaems, a safety engineer, concluded that the way to prevent punch presses from removing fingers was to not to install guards but to redesign the press so that the worker never had to put a hand under the ram. He installed an inclined press feeder, allowing it to be fed from the side, and installed a mechanical kick-out. The results were startling. In 1919, Kaems reported that his design not only eliminated injuries but also increased output by more than 100 percent[83].

[83] Information on the Safety Movement is based on Aldrich (1997:148-150). The claimed link between safety and productivity is fundamental also today, for instance forming the basis for the ILO intervention method that I used in the small company setting in Durban, reported in the next chapter. Figure 42 (page 240) in that chapter shows precisely a punch press intervention, essentially similar to the one pioneered in 1919.

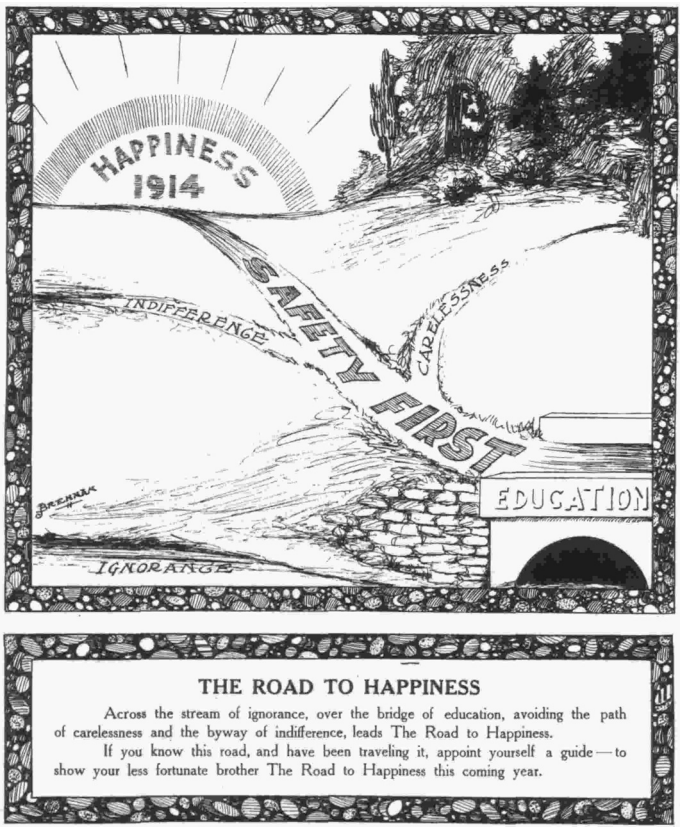


Figure 26 Safety First -- The road to happiness

Late in 1913, US Steel beckoned workers across the stream of ignorance, over the bridge of education, and onto the Safety First road to happiness. The wording indicates that the adherents of the Safety Movement pursued a broader (moral) agenda than just technical safety.

Source: Aldrich 1997:125

Whilst efficiency and increased output played an important role in justifying the existence of the newly institutionalised Safety First movement, Aldrich (1997) argues convincingly that the new safety professionals also felt a moral imperative to improve workplace safety, following the 'road to happiness' (Figure 26). Maiming workers was not only inefficient, it was also immoral, and many early safety professionals felt a strong sense of social indignation.

In 1931, Herbert W. Heinrich, a safety engineer, wrote the enormously influential book *Industrial Accident Prevention*, which was translated into several languages and remained a standard text within the OHS field for half a century.

My own copy of the book is a revised edition published in 1980, eighteen years (!) after his death (Heinrich et al. 1980).

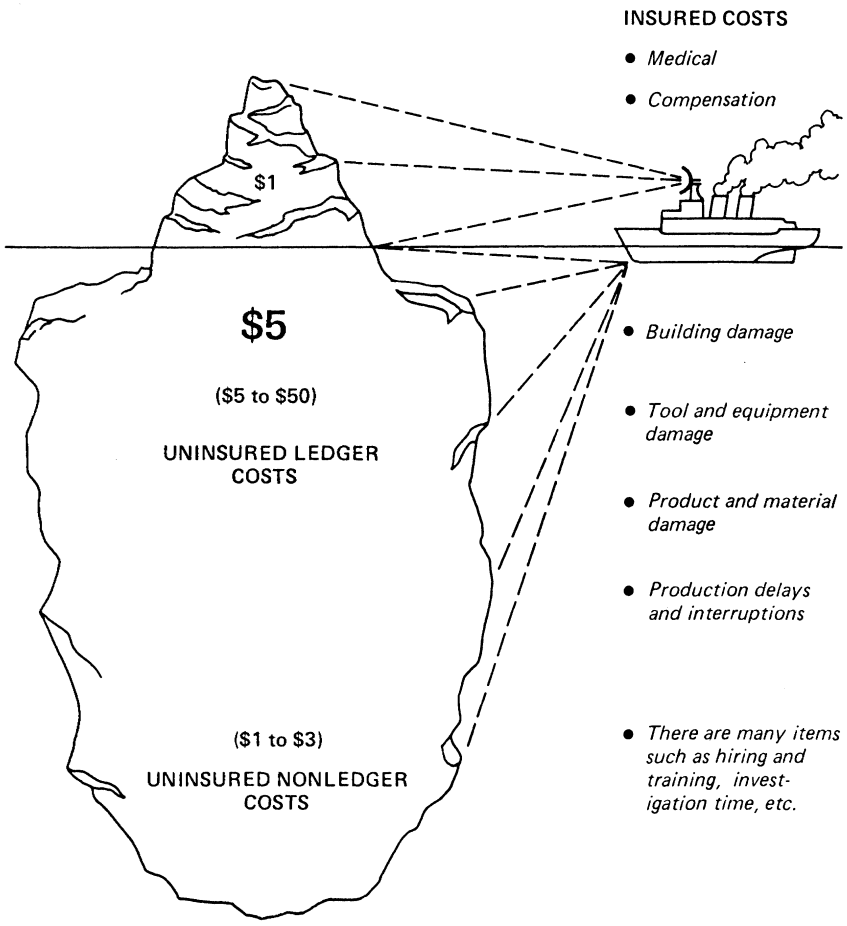


Figure 27 The indirect costs of accidents, the Heinrich iceberg of the 1930s

Note the similarity to the chemical cost iceberg in cleaner production supply chain management, see Figure 17page 121.
Heinrich established the 4 to 1 ratio in 1928. The iceberg shown here is a later version (the so-called Bird iceberg) with higher costs, while true to the original iceberg principle of hidden costs of accidents

Source: Heinrich et al. 1980:89

Heinrich estimated in 1928 that on average the indirect costs of an accident were four times higher than the direct costs. Heinrich's 'rule of four', which became known as the iceberg principle of hidden costs, enabled safety experts to justify their efforts and solidify their corporate position.

Heinrich also defined a so-called 'domino theory' of accident causation in which accidental injury was viewed as a series of propagating events. If the series is interrupted by the elimination of one or more of these events, the accident sequence is interrupted and injury cannot occur. The Nosa system's homage to the ideas of Heinrich is particularly evident in the Nosa axioms quoted above are almost a verbatim quotation from Heinrich's original axioms (Heinrich et al. 1980:17).

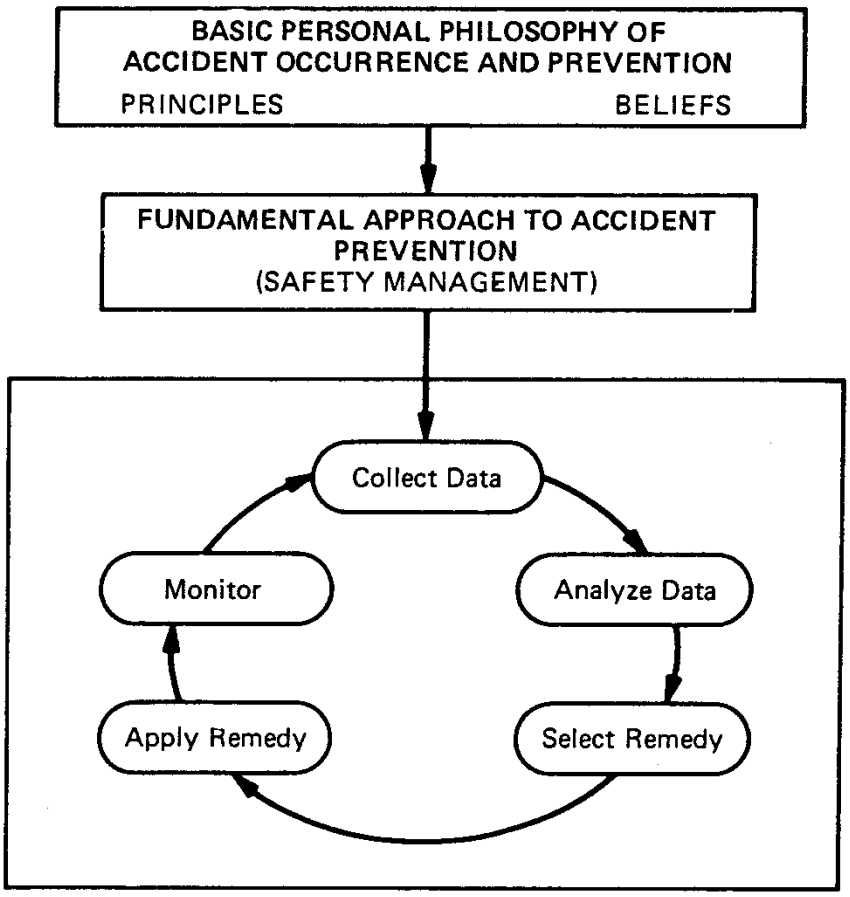


Figure 28 Fundamental approach to accident prevention

Note: There is a striking similarity between this approach taken from the 1980 version of Heinrich and

1. the recommended approach to environmental management and cleaner production (see Figure 14 page 118)
2. the Deming plan-do-check-act (PDCA) management circle currently in use in total quality management (see Figure 16 page 120)

Source Heinrich et al. 1980:12

The 1980 edition reads: "Accident prevention is both science and art. It represents, above all other things, *control* – control of worker performance, machine performance, and physical environment. ...[...]... accident prevention is a vital factor in every industrial enterprise, one which if ignored or practiced unskillfully, leads to needless human suffering and business bankruptcy." (Heinrich et al. 1980:4, emphasis added). Interestingly, the CP approach and the Deming principles of management in TQM are also concerned with control, see pages 118-120.

In Heinrich's view, accidents were caused only by 1) unsafe acts of persons, *or* 2) exposure to unsafe mechanical conditions. Consequently, they should be prevented by encouraging safer work habits *and* by engineering revision. However, in many interpretations,

the focus on safer work habits tended to overshadow the focus on engineering revision. The 1980 edition reads that "... in the occurrence of accidental injury it is apparent that *worker failure is the heart of the problem* and that methods of control must be directed towards worker failure" (ibid:4, emphasis added) while at the same time also stating that "Whenever there is an opportunity to make a dangerous condition foolproof mechanically, this should be done whether or not personal unsafe action exists" (ibid:5).

In newer times, an often raised criticism of Heinrich's ideas has been that they may lead to victimisation of the injured person. Research in the 1930s, for instance, indicated that some workers seemed to be 'accident-prone', another word for careless and negligent -- a first step towards an approach of fitting the worker to the task rather than fitting the task to the worker. More generally, Heinrich's approach to accident prevention has been criticised for its Tayloristic approach to accident prevention, of its one-best-way approach to safety, and of dividing safety interventions into separate planning and an execution components.

However, of particular interest to this study are the similarities between Heinrich's approach to accident prevention and the DTI approach to CP. Adherents of both approaches rely heavily on cost-efficiency considerations to advance their cause with industry whilst they at the same time also fight for a 'just cause' against social injustice (OHS) or future global environmental disaster (CP). Both argue that only a fraction of the costs are immediately visible, that the hidden costs are far larger than the direct costs, employing an iceberg metaphor to visualise this relationship. Both approaches strive to attain a larger degree of *management control*. Their approach to systematic management is similar in nature, the only major difference being the concept of continuous improvement, which is a new concept from the quality management field, and absent from Heinrich's old approach to accident prevention.

With so many similarities, claims that the approach should largely be a failure within the OHS domain, and at the same time a manifest success within the environmental domain, bears further examination.

The critique of 5-Star safety systems

Several authors have noticed that very little empirical research has been undertaken to evaluate the effectiveness of occupational health and safety management systems (OHSMS), for instance Gallagher et al. (2000:22). The few studies that I have been able to identify have been highly critical.

The only study reported in the international literature, which was based on own empirical data, was an examination of the safety performance of South African mining companies, published in 1988. This study depicted 5-Star systems as a sham, finding no evidence that the system

was able to lower accident rates (Eisner and Leger 1988b). In a recent book on OHSMS, two authors observe that: "There is much testimonial support for the efficacy of OHSM systems from promoters [...] and business users [...], but *what little available empirical evidence there is* paints a less rosy picture." (Nichols and Tucker 2000:304, emphasis added). The two authors then refer to the old 1988 paper on South African mining companies, to back their assertions.

Eisner and Leger (1988a) examine accident statistics of South African mines classified in the top 5-Star bracket of the so-called International Mine Safety Rating (IMSR) scheme -- one of three Star rating arrangements in use in the mining industry at that time. They observe that while lost-time injury frequency rates (LTIFR) have declined, fatality rates have not, casting doubts over the claim that a decline in the LTIFR are indicative of improvements in mine safety. They refer to a study by Shannon and Manning (1979) in which modifications to the accident reporting system of a large company led to a significant decrease in the number of reported accidents. When the modifications to the accident reporting system were reversed, the number of reported accidents rose and returned to their pre-change 'normal' level. Lost time accident rates used as measures of safety performance should therefore be "treated with great caution"(Shannon and Manning 1979:252). Eisner and Leger (1988a:4) conclude that fatality rates and serious-injury rates are much better measures of changes in safety performance than LTIFRs.

The claim that lost-time injury frequency rates (LTIFR) are simply too volatile to be used as reliable measures of safety, a point raised already by Lord Robens (1972:134-136), has very far reaching implications for OHSMS evaluation studies. Most OHSMS will bring about some change in the company's accident reporting system. According to Shannon and Manning (1979) this change will render impossible any before-after analysis based on LTIFRs produced by that accident reporting system. If only the very rare occurrences of fatal and permanently disabling accidents are reliable evaluation measures, extremely large samples are required in order to produce statistically significant results. Not even workplaces with tens of thousands of employees will have 'enough' fatal accidents to make a statistic analysis meaningful.

In a key paper the same authors undertake a critical review of the ISR 5-Star scheme in South African mining (Eisner and Leger 1988b). They note that without evidence to the contrary it must be doubted whether a comprehensive system of this kind "can genuinely be implemented and honestly audited by the average mine." (ibid:148). Auditing is a joint operation between mine management and external auditors and, arguably, biased. They note that the very competitiveness between mining companies engendered by the Star awards can lead to anything from, at best, wishful thinking to, at worst, falsification of records. The value of Star award schemes must

therefore be in doubt. Most importantly, they find no correlation between the Star rating and accident rate. "Thus, *whatever the effect* of the ISR on mine safety, *it does not appear to manifest itself in relative accident rates*" (ibid:156, emphasis added).

In 1991, Guastello performed secondary statistical analysis in order to assess the effectiveness of the International Safety Rating System (ISRS) 5-Star scheme. Data were from South African gold mines, Australian coalmines, North American companies and two New Zealand companies. Guastello's analysis showed that "the ISRS program has *no discernible effect* on accident rates" (Guastello 1991:253, emphasis added). And he concludes that "*there remains little support for the claim that the ISRS is an effective means of accident control*" (ibid:259, emphasis added). Finally, he observes that while "testimonial evidence" for the effectiveness of the ISRS was abundant, reasonably controlled experiments had not been published.

Guastello's 1991 critique exhibits several common characteristics with other papers, for instance Leger and Macun (1990), Gallagher et al. (2000), and Nichols and Tucker (2000). While the authors on the one hand lament that reasonably controlled studies of 5-Star systems have not been carried out, they make no attempt to remedy this situation by collecting new empirical data in a controlled manner. Rather, they refer to older studies or evidence of an indirect nature.

This study will not enter a discussion if the 5-Star systems of the 1980s were able to improve workplace safety or not. Certainly, the exorbitant fatality rate amongst black workers in South African mines in the 1980s (see pages 88-89) would appear to indicate that safety management systems of that sector were not particularly advanced. This kind of common sense reasoning supports the critical studies. On the other hand, the critical studies themselves, particularly the ones raised by Eisner and Leger (1988b) and Guastello (1991) can be criticised for unsound statistical reasoning and for using data of poor quality (Hedlund 2001). Whatever the case, now a decade later, the critical studies remain unchallenged and continue to inform the present debate, as will be show in the next section.

Impact of the 5-Star critique

The 5-Star critique has had a significant impact on the international debate. The Eisner and Leger (1988b) paper has been quoted on a number of occasions. Recent occasions include reports prepared for the Australian National Occupational Health and Safety Commission. Worksafe Australia, on positive OHS performance indicators (Shaw 1994) and on the effectiveness of OHS management systems (Gallagher et al. 2000). The paper was also quoted in a recent book on occupational health and safety management systems (Nichols and Tucker 2000) and in two recent OHS intervention studies (Chaplin and Hale 1998, and Alteren 1999:233)

Although not quoted specifically, the paper may have informed (and disadvantaged) some of the recent discussions concerning the development of international guidelines on occupational safety and health management systems. Quoting from a recent ILO information note: "The term 'OSH management certification' covers a variety of different activities with different scopes and objectives, and *there is only limited proof of its positive results and value with regard to the prevention of accidents* and diseases and the improvement of working conditions." (ILO 2001:18, emphasis added).

The 5-Star critique has also influenced the South African Public Commission of Inquiry into Safety and Health in the Mining Industry (Leon Commission, 1995). The Commission "... concluded that, although these [5-Star] safety management systems may have made some contribution to improving safety at some mines, they had become largely discredited in the eyes of those employed at the mines and in public perception, because of the very large disasters that continued to occur at mines with high star ratings, and *their imperceptible impact on the overall level of fatal and major injuries* in South African mines. While mining companies and mines must be free to use these systems if they feel they will assist them in improving health and safety, the *Commission finds no basis for encouraging the adoption of these systems*." (Leon Commission 1995:vol 1, p77). In its closing submission to the Leon Commission, the National Union of Mineworkers, NUM, pledged that "No public funding should be made available to 'loss control' approaches, or operating safety rating systems" (ibid:vol 2, p8) -- a critique directly aimed at Nosa, which during the 1990s received funding from the Workmen's Compensation Fund.

The 5-Star critique leads Lewis (1994) to conclude, that 'the fact' that Star ratings do not reflect how many deaths and serious injuries that take place "is a major source of their [worker unions'] dissatisfaction with Nosa's Star grading system" (Lewis 1994:17). A union newsletter reporting from an OHS conference from the National Union of Metalworkers of South Africa (Numsa) reveals that claimed union dissatisfaction also has other reasons. "Nosa's past is dubious. There are allegations that it would pre-warn employers when it was going to do an inspection so that the factory was 'safe' on the day of the visit. For this reason, COSATU [the largest trade union confederation] and its affiliates have taken a resolution that *we should have nothing to do with Nosa*. But Numsa safety reps [...] questioned 'who is going to train us if we throw out Nosa?' " (Numsa News 1996)

Whilst discredited amongst academia, commissions of public inquiry and trade unions, the Nosa 5-Star System appears quite popular amongst industry, as I first learned during the visits to the fish processing factories. A literature search in the Index to South African Periodicals (ISAP) database from 1986-1999 revealed a total of 104 articles that contain the word 'NOSA'. Only two of those articles appear to be critical of Nosa, and that is the Lewis (1994) paper

published in two different journals. The majority appear positive, like "Using scaffolding safely: life-saving information from Nosa" and "Safety must be implemented methodically, says Nosa", published in Martin Creamer's Engineering News, South African Sugar Journal and other industry journals.

This divergence of opinion is intriguing and could by itself warrant a further study of the effect of 5-Star Safety Management Systems. However, the prime justification of the present study is rooted in considerations about integration at the level of methodology.

OHS performance indicators

The problem with traditional indicators of negative outcomes

Any occupational health and safety management system (OHSMS) or OHS intervention will ultimately have to be evaluated against its ability to lower the number of accidents and occurrences of work-related ill-health. For sake of simplicity, let the following discussion be confined to the 'narrow concept' of workplace safety. This excludes issues of workplace ill-health, where long latency periods between exposure and effect may obscure the illness being registered as work-related and further distort registration. This limitation of the concept also excludes issues of well-being at work, burn-out, stress, etc. With the discussion so confined to the 'narrow concept' of workplace safety, the standard performance indicator is the number of lost-time accidents relative to the number of hours worked, commonly computed as the Lost Time Injury Frequency Rate (LTIFR).

The are, however, a number of very serious problems with the LTIFR as a reliable indicator of safety performance. First, there is the problem of the rare occurrence of accidents. It is obvious, that the absence of a rare event is not by itself a good indicator for the performance of a safety management system. A low accident rate is neither a guarantee that risks are being effectively controlled nor will it ensure the absence of injuries in the future. In any particular workplace, only a few, if any, accidents may occur each year. Variations from year to year are therefore likely to be statistically insignificant, that is, it is impossible to tell if the variation is the result of chance fluctuations or the result of a real change in safety performance. Changes in LTIFRs are therefore a poor guide to changing levels of safety (Hopkins 1994)

Second, the LTIFR measure is volatile, susceptible to a range of conditions, which have nothing to do with safety. One such condition is the nature of the accident reporting system, as observed by Shannon and Manning (1979) referred to earlier. When the accident reporting system changed, so did the number of reported lost-time incidents. Another type of difficulty arises from social processes when accident reporting is linked to reward systems. If, for instance, accident reporting is linked to insurance coverage, over-claiming behaviour

may be the result. On the other hand, when accident reporting is linked to paid incentives for long accident-free periods, claims suppression may occur.

In a study of a US saw mill, Grunberg et al. (1996) observed that team based awards often ended up creating substantial peer pressure not to miss work -- a worker who lost the tip of his finger in an industrial accident returned to work from the hospital on that same day saying 'I don't want to lose my $50' (ibid:230). In Japan, peer pressure and the fear of losing face have led workers to hide broken bones and severe lacerations (Wokutch and Sandt 2000:381). The very low accident rates reported for the Japanese auto industry have been linked to widespread under-reporting practices. A US safety director for a Japanese owned auto production facility in the US doubted that pains and aches were recorded in Japan, as they were in the US auto industry. He said "You have to have a broken bone or some blood before it's recorded [in Japan]" (quoted in Wokutch 1992:192)

Third, that the LTIFR is a fundamentally unsatisfactory performance indicator because it deals solely with negative outcomes, and not with upstream indicators of the processes that determine these outcomes. From a preventive viewpoint, the LTIFR is inadequate because it is a reactive measure, one of failure. The LTIFR gives no guidance to efforts of a more proactive nature that may prevent accidents or improve the safety performance.

Positive performance indicators for OHS ?

A 1994 workshop sponsored by the Australian National Occupational Health and Safety Commission, Worksafe Australia, sought to explore if there are more useful indicators than the LTIFR and how such indicators possibly could be developed. The concept of Positive Performance Indicators (PPI), capable of showing improvement in *process* rather than *outcomes*, were explored at length in the workshop proceedings (NOHSC 1994). Relevant categories for positive measures of OHS performance were, for instance 'Workforce contribution', 'Internal Processes', and 'Innovation and Learning'

Examples were given of generic indicators such as the role, status and effectiveness of hazard reduction programs, to more specific indicators of control procedures in place, action taken to meet agreed standards, the safety consciousness, morale, and the extent of workplace participation in safety issues. The indicators themselves may take a number of different forms. First, they may be *relative*, measuring a percentage increase or decrease in, for example, a positive indicator such as ‘safety audits completed with a satisfactory score’. Second, indicators may measure an *absolute* level or amount, for example, the ‘hours of training per employee with an OHS content’. Third, they may record steps in the implementation of an agreed program, for example, ‘completion of Phase 1 of the XYZ hazard reduction program by [date]’. The workshop participants emphasised that the

practical viability of a performance measurement system would often be determined simply by its relevance to the individual circumstances of the workplace. The workshop participant eventually concluded that: "It is clear that amongst OHS professionals there is an understanding that PPI can be developed and there is awareness that because they are linked to processes at enterprise level, *PPI need to be enterprise specific*." (Blewett 1994, emphasis added). In other words, positive performance indicators do exist, they are useful and viable, however at the same time also company specific. Thus, universally accepted indicators cannot be defined, the workshop participants concluded.

This conclusion of the workshop returns the focus of this study to the question, if it is possible for an independent organisation to verify, and possibly certify, the quality and adequacy of 'upstream' preventive OHS activities. The answer to this question has two important practical applications.

First, it was argued that tradition reactive measures of workplace safety (e.g. the LTIFR) had severe shortcomings and were fundamentally unsatisfactory and inadequate. But if neither reactive nor proactive universal measures of OHS performance are available, on which basis should the adequacy of OHS preventive activities then be determined?

Second, within the environmental and quality management domain, the ability of independent organisations to verify and certify that the management processes conform to a set of 'minimum standards' has been an extremely important factor in the large scale adoption of such systems. If similar certification schemes could not be devised within the OHS domain, the prospects for widespread adoption of OHSMS could be gloomy.

It has been unfolded at length above, that the 5-Star critique holds that there is no relation between a company's Star-rating and its accident performance. In effect, the critique holds that a 5-Star system audit cannot determine the quality and adequacy of a company's accident prevention efforts. The general problem is if an audit score can predict the accident performance of a company. Surprisingly, and somewhat disappointingly, it has only been possible to identify 2 (two!) studies on this general topic in the international literature, despite its obvious relevance to OHS management and certification schemes. Intriguingly, they only offer limited optimism in respect of the viability of auditable and certifiable safety management systems. They are discussed in the following two sections.

United States motor carrier safety audits

Deregulation of the United States interstate motor carrier industry in the 1980s brought worries of increased accidents. It was feared if competitive pressures on trucking firms and the influx of new carriers would compromise existing levels of safety[84]. In response, the US government enacted legislation that raised minimum quality standards and made more resources available to ensure compliance with the law. The 1984 Motor Carrier Safety Act, and the 1986 Commercial Motor Vehicle Safety Act established national standards for driver and vehicle licensing and provided for increased penalties for violations.[85]

The US government also expanded enforcement activities. This included, among others, an overhaul of the system of audits of the safety practices of firms. In 1986, federally employed inspectors attempted to identify the estimated 185,000 firms, that had not been audited under the previous system, and conduct audits of their compliance with federal safety laws. Many of the firms were small operators that had entered interstate commerce after deregulation had taken place.

The inspectors visit the operating bases of firms and question managers about safety related procedures and policies, such as those governing maintenance, and driver hiring and training. They do not actually inspect any equipment of test drivers. The inspectors have a list of 75 questions, grouped under nine headings. The inspector marks a 'yes' or 'no' answer to each question. The inspector asks:

- 13 general questions, for instance: 'Does the individual in charge of safety have authority to terminate drivers?
- 6 questions on reporting of accidents, for instance: 'Can the carrier explain the definition of a reportable accident?'
- 5 questions on drivers, for instance: 'Does the carrier have a policy for monitoring speed?'
- 12 questions for hours of service, for instance: 'Can the carrier produce the prior 6 months records of duty status for a driver selected at random?'

and so forth. The inspector then rates the carrier as 'satisfactory', 'conditional', or 'unsatisfactory' in each of the nine areas, and assigns an overall rating to the firm. If a firm is found to be unacceptable in any way, a return visit is made to the carriers. This visit is much more detailed, involving 28 staff hours against the 2-3 hours for the initial visit. While the enforcing authority has a policy of not initiating

[84] A review of those concerns and actual (declining) accident rates is provided in Hunter and Mangum (1995)

[85] Factual information in this section is from Moses and Savage (1992)

citations for violations found during the initial visit, the return visit may involve legal enforcement activities, collection of evidence etc. Additionally, some large shippers, such as Chrysler Corporation and the Department of Defence, have policies of contracting only with motor carriers that have been rated 'satisfactory' in the federal safety audit. There are thus obvious incentives for companies to pass the safety audit during the initial visit with a good rating.

The motor carrier audit system is similar in principle to the Nosa audit scheme. An outside auditor arrives at the company gate armed with a comprehensive and objective rating system with which he intends to measure the preventive safety efforts of that company. One would, however, be justified in presuming that a motor carrier audit would be easier to accomplish than an audit of a general company. Interstate motor carriers exhibit many common characteristics; the risks of the companies are more or less similar, and so are the preventive measures. On the other hand, an audit of a general company would presumably be far more difficult. The target group is much more heterogeneous. Different companies face different risks and the auditor would first have to assess if all major risk have been identified, and then, the extent to which the preventive measures in place are adequate. It is therefore reasonable to expect that, *ceteris paribus*, a federal safety audit of a motor carrier is simpler and provides a truer picture of the preventive safety efforts, than a safety audit of a general company.

Moses and Savage (1992) examine the results of a sample of 13,053 safety audits of firms and compare the audit results with the firms' accident experience in the previous 365 days. After correcting the data set for multicollinearity and making other adjustments, the authors end up with 45 safety audit questions, which they regress with the accident experience data.

Their results afford little comfort for the viability of certifiable safety management systems. A regression of audit question scores with the number of total accidents reveals that 17 of the 45 regression coefficients (38 percent) have *counter intuitive signs*. That is, the better the company does on the audit questions, the worse is its accident record! If the regression is carried out with the number fatalities and injuries as the dependent variable, the audit score performance is even worse; 24 of the 45 regression coefficients (53 percent) have counter intuitive signs!

The Moses and Savage (1992) study shows that there are a number of issues strongly related to accident occurrence. These include:

- the appointment of a safety director with control over hiring and firing drivers,
- obtaining independent verification of the background of new hires,
- disciplining drivers involved in 'preventable' accidents, and
- monitoring drivers' hours-of-service.

These issues appear to be able to predict the safety performance of trucking, thereby offering some optimism for certification. Yet, the overall conclusion is that the worse the firm does on a large part of the audit, the better is its accident record!

Based on the audit results the inspector assigns an overall rating to the firm, as: satisfactory, conditional, or unsatisfactory. The inspection authority repeatedly refused to reveal the exact formula by which the overall rating was computed from the audit item scores. The extent to which inspectors use the 'good' or 'poor' predictors (item scores) in their overall assessment is therefore not known.

But, by and large, inspectors appear to be able to rate firms correctly (Table 14). Companies rated as 'satisfactory' indeed had a lower accident rate than companies rated 'unsatisfactory', although the difference is quite small. It is worthy of note however, that many of the companies, which had not been audited under the previous system, were rated 'conditional'. Yet, they have the lowest accident rate by far.

The authors offer some explanations for these surprising conclusions. Many small firms are allegedly unaware of the federal regulations, and hence do not maintain the necessary paperwork to pass the audit. Yet, they have good and safe business practices. In contrast, there are larger firms that are familiar with the audit process and hence can arrange to have the documents to support a 'yes' answer to the questions in the audit, even if the relevant safety practices are not in place. Allegedly, there are also consulting companies that will advise trucking firms in how to pass the audit.

While these explanations offer insights into the difficulties of safety system auditing, the overall conclusion remains that safety audit scores are not very effective in predicting safety performance[86].

[86] The authors expanded the analysis in a study on a larger data set involving audits of 75,577 firms (Moses and Savage 1994), which, by and large, confirmed the previous results.

Table 14 Relationship between overall inspector rating of audit and accident performance of motor carrier. Firms rated 'conditional' in audit have the best accident performance!

	Overall firm rating by inspector		
	Satisfactory	Conditional	Unsatisfactory
Percent of total firms	43%	51%	5%
Percent of total mileage	71%	23%	6%
Accidents per million miles	5.28	3.13	5.63
Fatalities and injuries per million miles (note)	0.32	0.29	0.42

Note: Trucking companies rated as 'satisfactory' by the inspector indeed had a lower accident rate than companies that were rated 'unsatisfactory', although the difference is quite small. Yet, firms rated 'conditional' in the audit have the best accident performance! Safety audit scores are apparently not very effective in predicting safety performance.

Detail: Difference between numerators in line 3 ('accidents') and line 4 ('fatalities and injuries') is that one accident may result in multiple injured people

Source: Moses and Savage 1992:483

Rating of US Navy shore facilities

United States Navy shore facilities are principally staffed by civilians who are exposed to the full range of occupational hazards addressed by Occupational Safety and Health Administration (OSHA) regulation. Although not subject to OSHA direct oversight and inspection, these facilities must comply with federal, Department of Defence, and Navy OSH requirements. The Navy Inspector General Oversight Inspection Unit (NOIU) consequently inspects the facilities in order to evaluate compliance with those requirements.[87]

A NOIU team of inspectors rates each facility in two areas: program and workplace.

1. The program rating evaluates and scores the degree to which records verify the successful implementation of a defined array of occupational safety and health programs, in effect an audit of the safety program's paper trail.
2. The workplace rating evaluates and scores safety attributes and discrepancies observed during field inspections of work areas.

The NOIU team produces two numerical evaluation measures: a program inspection score and a workplace inspection score. Both are expressed as a percentage of the maximum possible point score. In effect, the NOIU inspection and scoring procedure appears materially similar in nature to the Nosa system audit and the Nosa field inspection. The only difference being that Nosa inspectors only produce one numerical *effort* score, and not two separate scores for program audits and workplace inspections.

Lindell (1997) compares scores from NOIU inspections of 85 facilities with accident experience data for those facilities. Two sets of injury rates were computed, one for all lost time injuries (LTIFR) and a second for severe injuries involving more than 45 days of lost time. He then computed correlation coefficients to assess the degree of association among inspection scores and injury rates.

Results are rather disappointing (Table 15) in respect of prospects for viable certification schemes. For instance, as expected, the program score is inversely correlated with the lost time injury rate (-0.03), that is, a high program score is associated with a low injury rate. But the correlation is weak (close to zero) and *not significant*. In fact, the only significant correlation is between the workplace score and the severe lost time injury rate, but only at the <0.05 level, a significance level normally considered only 'weak experimental proof'.

The study by Lindell (1997) therefore confirms the conclusion of the previous study by Moses and Savage (1992), that safety audit scores are not very effective in predicting safety performance. Only the

[87] Factual information in this section is from Lindell (1997)

workplace score, based on field inspection of safety practices, has a significant inverse association with one of the measures of safety performance. The program score, based on an audit of the management system paper trail, has no significant association with any measure of safety performance!

Lindell (1992:568) offers an interesting explanation for this lack of association. The program score is uniformly high, and the average score of 0.89 is only one standard deviation from the maximum possible score of 1.00. Therefore, the program score is a poor predictor variable. It may be possible that specific components within the program score have a greater variation and thus are more predictive of injury rates. However, his data do not allow testing of this proposition. This explanation may also be relevant for the Nosa 5-Star system, which also exhibits tendencies to 'Star-saturation', that most Star-ratings are within the top 4 and 5-Star brackets.

Table 15 Correlation coefficients between program score, workplace score, and injury rates

	Program score	Workplace score	All lost-time injuries rate	Severe lost-time injury rate
Program score	1.00			
Workplace score	0.35 **	1.00		
All lost-time injuries rate	- 0.03	- 0.12	1.00	
Severe lost-time injury rate	- 0.08	- 0.23 *	0.69 **	1.00

Note: The program score is inversely correlated with the lost time injury rate (-0.03), that is, a high program score is associated with a low injury rate, but the correlation is weak (close to zero) and *not* significant. Safety audit scores are apparently not very effective in predicting safety performance.

Legend:
Coefficients are of the Pearson's r type. Significance level are denoted by * $p<0.05$, ** $p<0.01$
Program score -- the result of system audit of paper trail.
Workplace score -- the result of field inspection of workplaces

Source: Lindell 1997:567

Comparative study on the accident experience of Nosa companies

Hypotheses and methodology

As argued at length above, two general hypotheses emerged as I reviewed the general literature on occupational health and safety management systems and earlier experiences with systematic scoring schemes that evaluated the quality of accident prevention efforts.

1. The first hypothesis is that systematic safety management activities are able to prevent accidents and lower the injury rate of companies that embark on such activities. That is, they are *effective*. The safety management activities in question have the following characteristics: They are of the top-down variety in which safety is a management responsibility, they employ bureaucratic and hierarchic rule, they employ a mixture of risk analysis techniques and checklist approaches, and the activity is embedded in a cost-efficiency discourse.

2. The second hypothesis is that universal pro-active safety performance *indicators* can be devised, which show improvement in process rather than outcomes. These indicators are so designed that they measure the quality of upstream preventive safety measures, thereby moving away from negative outcomes, which are essentially reactive indicators of failure.

As described earlier in this chapter, the Nosa organisation has offered its 5-Star occupational health and safety management system to South African industry for more than 20 years. Hence, the South African setting and the Nosa 5-Star system represented an obvious opportunity to test the two hypotheses based on extensive empirical data. Specifically, the testable hypotheses are:

1. Companies that are committed to the Nosa system experience fewer fatal and seriously disabling accidents than other companies.

2. The Nosa 5-Star rating is inversely correlated with incidence rates for fatal and seriously disabling injuries.

A comparative study involving two cross-sectional surveys was undertaken to test the hypotheses. The universe was defined as all companies in the South Africa manufacturing industry, which had been Star-rated by Nosa at least once during the 3-year period 1997-1999.

Raw lists of companies and audits were received from all ten regional Nosa offices creating a master list of 2,596 companies. Some companies were only purchasing training, not auditing, services, or were on the lists for other reasons. Purging companies with no audits in the 3-year period of interest reduced to the list to 1,037 companies.

Companies with a postal address outside South Africa were taken off the list. Each list entry was then examined in order to determine if it was in the manufacturing sector, defined as categories 6-14 in the Workmen's Compensation Commissioner's (WCC) annual statistics. This process identified a universe comprising 399 companies.

The first survey involved a two-page questionnaire, which was mailed to all 399 companies, attention the Safety Officer or the General Manager. The questionnaire solicited their Star-rating, number of employees, and number of fatal and permanently disabling injuries for the period 1997-1999, and other information.

This postal questionnaire method relies on the respondent's ability to correctly recall events 3 years back in time, and may consequently be biased. The objective of the second cross sectional survey was therefore to seek similar data from an independent source, the Workmen's Compensation Commissioner (WCC), who, however, only have data available for the earlier period 1994-1995 (see Hedlund 2000). There are no direct means available by which to determine which companies were rated by Nosa in 1994-1995. An indirect procedure produced a sample of 50 companies, which was forwarded to the WCC, who returned aggregate numbers of employees, fatalities and permanently disabling injuries for 1994-1995. The procedure is described in more detail in Hedlund (2001). The survey activity took place October 1999 - July 2000.

The only available control group to compare against is the national accident statistics for manufacturing. In principle, two sources of national accident statistics data are available, from the Department of Labour (DOL) and from the Workmen's Compensation Commissioner (WCC). Nosa registration requirements for fatal and permanently disabling injuries match those of the WCC only, not those of the DOL. But unfortunately, the WCC data have serious shortcomings. First, the most recent WCC data available in mid-2000 were from 1995, not covering the period surveyed in the postal questionnaire. Second, the WCC accident data exhibit an unexplained high year-to-year variation, compared to DOL data.

Figure 29 depicts the number of fatal accidents for almost 30 years according to DOL records and WCC records. DOL figures are lower than WCC, principally due to the scope exclusion of traffic accidents occurring during the course of work. DOL data also exhibit a far smaller year-to-year variation than WCC data, indicative that DOL data are more reliable. Statistical analysis of accident and employment statistics for about 30 years involving multiple regression techniques was employed in order to obtain proper WCC accident and employment data for 1997-1999 to compare against. This was a major task covered separately in Hedlund (2000).

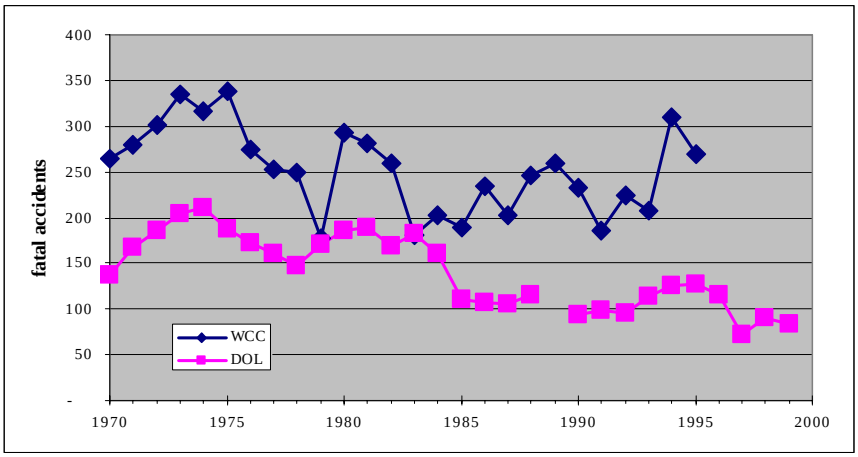


Figure 29 Number of fatal accidents in manufacturing 1970-1999, according to WCC and DOL data

Workmen's Compensation Commissioner (WCC) accident registrations exhibit an unexplained high year-to-year variation compared to Department of Labour (DOL) registrations. By mid 2000, when this data collection exercise was finalised, the most recent WCC data were from 1995, unfortunately not covering the period of study. This complicates the use of WCC data in the comparative study.

Source: Yearly statistical reports from WCC and DOL as described in Hedlund (2000)

In summary, two surveys were undertaken, each with its own set of limitations. The first survey, a postal questionnaire, covers 1997-1999. The companies committed to the Nosa system are well defined, but the accident performance of the control group, the national average for manufacturing, has to be estimated indirectly. The second survey, a sample of WCC records 1994-1995, allows a direct estimation of control group parameters, but the companies committed to the Nosa system have to be identified indirectly.

Findings

251 companies returned the postal questionnaire, equivalent to a 63 percent response rate. Seventeen companies indicated that they were not in the manufacturing sector or that they had not been audited, reducing the number of useful questionnaires to 234.

Those companies reported that 592 audits had taken place during 1997-1999. The distribution of awarded Stars, presented in Figure 30, shows a 'Star saturation' effect -- the 5-Star category is the most prevalent closely followed by the 4-Star category.

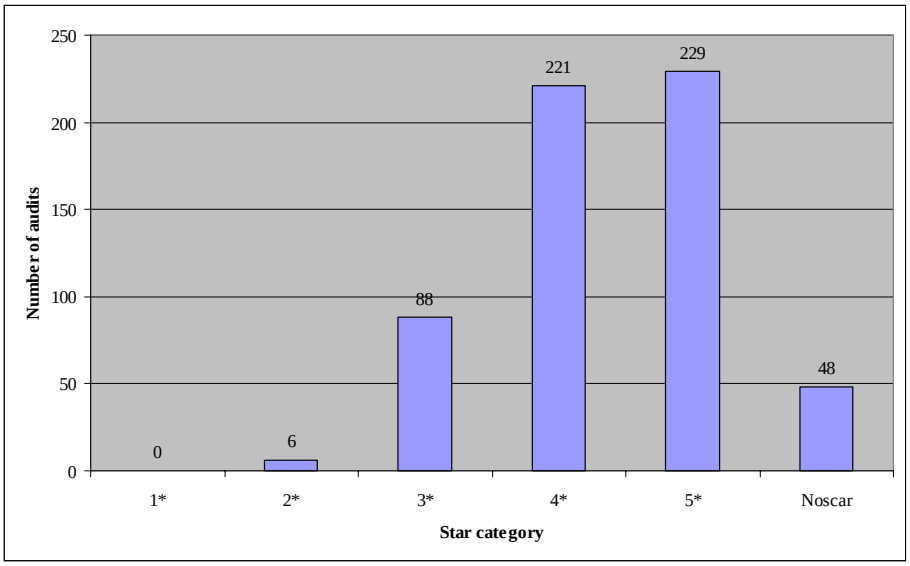


Figure 30 Distribution of awarded Stars exhibits a "Star saturation" effect

There are most five-Star category companies, closely followed by four-Star category companies.

Note: The Noscar rating is sort of a sixth Star (see footnote 82 on page 170)

Source: Hedlund (2001)

The accident performance of companies in different Star categories computed from postal survey data are shown in Table 16 and Table 17. Some companies reported the number of fatal injuries, but not the number of permanently disabling injuries, in particular for the early years in the period, perhaps due to inconvenience if it would require retrieval of old records. There are therefore fewer employee man-years for the permanently disabling injury category.

The estimated overall incidence rates ('all categories') for Nosa companies 1997-1999 have been subjected to one-sided statistical tests[88] in order to reveal if they are significantly lower than the incidence rates for the general industry.

The fatality rate is significantly lower ($p<0.01$) than the estimated Workmen's Compensation Commissioner (WCC) rate for the manufacturing sector for the same period, which is 1.50.

The permanently disabling injury rate, is also significantly lower ($p<0.001$) than the WCC rate for 1995 (the most recent), which is 25. Both WCC rates are taken from Hedlund (2000). There is thus strong empirical evidence that manufacturing companies committed to the Nosa system have both fewer fatal and permanently disabling injuries than the national average for manufacturing.

[88] The following null-hypothesis is tested using a one-sided test for a Poisson distributed variable: H0: $rate_{NOSA\ companies} >= rate_{WCC}$. The test is carried out computing the upper one-sided confidence interval for n injuries, which is $0.5\ Chi^2(2(n+1))$

Table 16 Results from postal survey -- fatal injuries in Nosa companies 1997-1999

		Fatal injury			
			Incidence rate pr 10,000 employees per year		
Star category	Employee years	Number of injuries	Estimate	95 % confidence interval	
<=3*	43,040	4	0.93	0.25	2.38
4*	96,523	15	1.55	0.87	2.56
5*	105,650	9	0.85	0.39	1.62
Noscar	45,256	0	0.00	0.00	0.82
All categories	290,469	28	0.96 **	0.64	1.39

Note: The fatal injury incidence rate per 10,000 employees per year (0.96) for Nosa companies is significantly lower than the general rate for the manufacturing sector for the same period, which is 1.50

Sample size is n=647 Star ratings from 234 companies
Significance levels ('all categories') are denoted by *<0.05, **<0.01, ***<0.001 (one-sided test)
Note: The Noscar rating is sort of a sixth Star (see footnote 82 on page 170)

Source: Hedlund (2001)

Regarding the **second survey**, the Workmen's Compensation Commissioner was not able to identify all 50 companies, which had been rated 5-Star in 1997, in his records for 1994-1995. One of the reasons is that a site in the Nosa system is defined by the physical premises "to the company fence", whereas the WCC records are based on employee identification numbers, possibly comprising more than one production site. A total of 44 companies (88 percent) were identified in the 1994-1995 records. Results are presented in Table 18.

Using similar one-sided tests, the 1994-1995 fatal injury rate is significantly lower ($p<0.05$) than the general WCC rate for the same period, which is 1.91. The permanently disabling injury rate is also significantly lower ($p<0.001$) than the WCC rate, which is 25. Both WCC rates are taken from Hedlund (2000).

Table 17 Results from postal survey -- permanently disabling injuries in Nosa companies 1997-1999

		Permanently disabling injury			
			Incidence rate pr 10,000 employees per year		
Star category	Employee years	Number of injuries	Estimate	95 % confidence interval	
<=3*	27,040	25	9.25	5.98	13.65
4*	71,295	28	3.93	2.61	5.68
5*	97,732	45	4.60	3.36	6.16
Noscar	32,256	8	2.48	1.07	4.89
All categories	228,323	106	4.64 ***	3.80	5.62

Note: The permanently disabling injury incidence rate per 10,000 employees per year (4.64) for Nosa companies is significantly lower than the general rate for the manufacturing sector for 1995 (most recent estimate), which is 25

Sample size is n=628 Star ratings from 229 companies
Significance levels ('all categories') are denoted by *<0.05, **<0.01, ***<0.001 (one-sided test)
Note: The Noscar rating is sort of a sixth Star (see footnote 48 on page 141)

Source: Hedlund (2001)

The commitment to the Nosa system of the companies in the WCC survey is ambiguous due to the indirect manner in which the companies were identified. Additional uncertainties were introduced during the process of data retrieval from the WCC records. The results, however, support the findings of the postal survey. It is therefore concluded that there is consistent empirical evidence that Nosa manufacturing companies have both fewer fatal and fewer permanently disabling injuries than the national average for manufacturing. This finding supports the first hypothesis, that the approach is *effective*.

Table 18 Results of Workmen's Compensation Commissioner survey 1994-1995

Injury type	Employee years	Number of injuries	Incidence rate pr 10,000 employees per year: Estimate (*note)	95 % confidence interval	
Fatal	67,925	5	0.74 *	0.24	1.72
Permanently disabling	67,925	111	16.3 ***	13.4	19.7

Note: Both the incidence rates for fatal injury and for permanently disabling injury per 10,000 employees per year for Nosa companies is significantly lower than the general rate for the manufacturing sector for the same period

Sample size is n=44 companies from the Workmen's Compensation Commissioner database

Note: Significance levels are denoted by *<0.05, **<0.01, ***<0.001 (one-sided test)

Source: Hedlund (2001)

It is interesting to examine if the Star rating is correlated to the injury rate. Do companies with a high Star rating have significantly lower injury rates than companies with a low Star rating?

Figure 31 and Figure 32 show plots of the injury rate estimates for different Star categories. Vertical error bars represent their two-sided 95 percent confidence intervals. The fatal injury rate of Noscar companies is significantly ($p<0.05$) lower than that of 4-Star companies, their confidence intervals do not overlap. Similarly, the permanently disabling injury rate of 3-Star (and lower) companies is significantly ($p<0.05$) higher than that of the other categories.

Although the internal ranking on Figure 31 and Figure 32 are not fully consistent it is notable that *any* line drawn through all confidence intervals will, for both injury types, exhibit a negative slope[89].

[89] Additional statistical tests were carried out. A Chi^2 test was used to test the null hypothesis: Injury rates of the four Star categories are similar to the aggregate injury rate. The null hypothesis was rejected ($p<0.001$) for permanently disabling injury injuries. It was also rejected ($p<0.05$) for fatal injuries, but the low number of injuries (slightly) violated the test's limits of applicability and this result should therefore be interpreted cautiously, if at all. The number of Stars is a non-parametric variable and it is consequently not meaningful to undertake linear regression analysis. If done, however, the slope of the regression line is negative, but it is *not* significant, not even at the 0.10

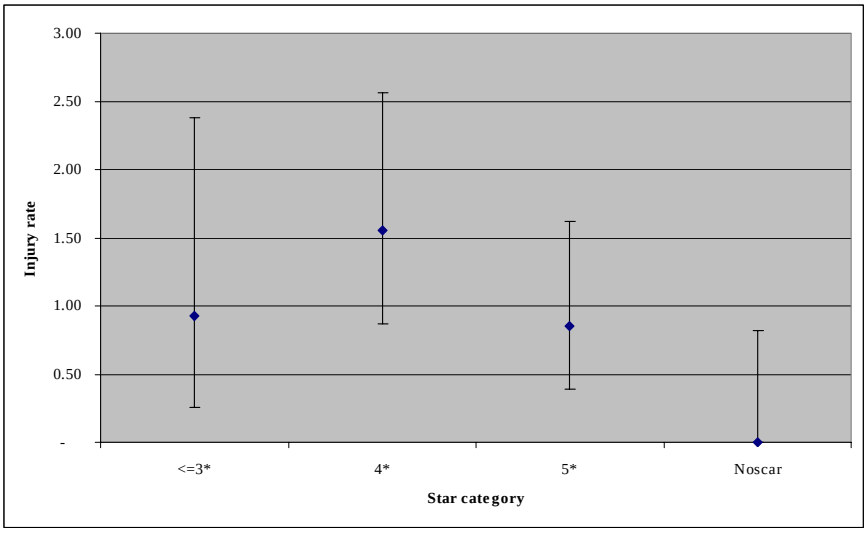


Figure 31 Fatal injury incidence rates per 10,000 employees pr year (dots) with 95 percent confidence intervals (bars) for various Nosa Star categories for 1997-1999.

Although the internal ranking is not fully consistent (discussed in text) it is notable that any line drawn through all confidence intervals will exhibit a negative slope

Note: The Noscar rating is sort of a sixth Star (see footnote 48 on page 141)

Source: Hedlund (2001)

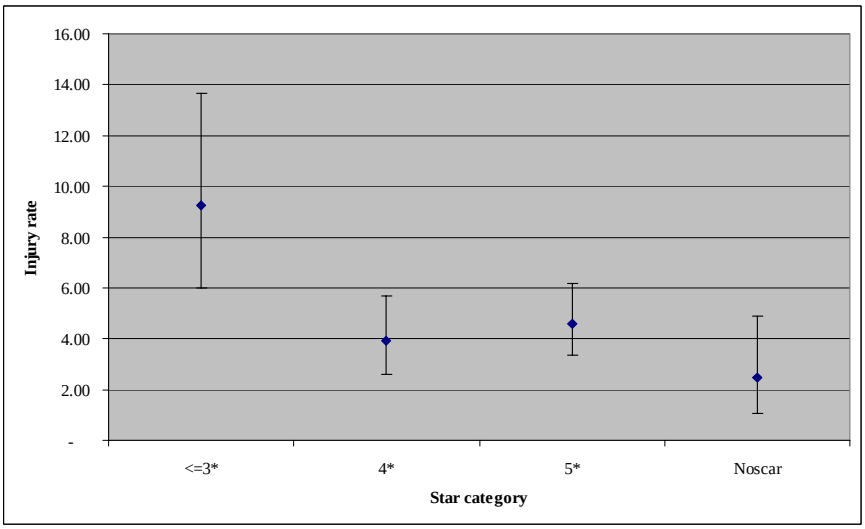


Figure 32 Permanently disabling injury incidence rates per 10,000 employees pr year (dots) with 95 percent confidence intervals (bars) for various Nosa Star categories for 1997-1999.

Although the internal ranking is not fully consistent (discussed in text) it is notable that any line drawn through all confidence intervals will exhibit a negative slope

Note: The Noscar rating is sort of a sixth Star (see footnote 48 on page 141)

Source: Hedlund (2001)

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significance level - similar to the findings reported by Eisner and Leger (1988b). This is possibly a Type 2 Error situation, that a linear regression analysis on only 4 data points will only show significance in cases with minimal scatter.

It is thus concluded that the NOSA Star rating is a significant, although imperfect, predictor of injury rates. This finding is supporting the second hypothesis of the comparative study.

Discussion

There are severe methodological complications when evaluating the effect of safety management systems. First, the choice of evaluation measure must be determined. Part of the 5-Star critique concerned that the Nosa system encourages aggressive monitoring of accident claims rather than addressing basic accident causes. This type of critique can only be addressed if the evaluation measure is confined to serious and fatal injuries. However, using the occurrence of serious injuries as a proxy for the less serious ones implicitly presumes an accident causation model in which identical causes precede minor and major injuries. It deserves mention, that this model has been contested on the grounds that the types of circumstances that produce fatalities are essentially different from those producing minor injuries (Salminen et al. 1992). If true, statistics on fatal injuries become less suitable evaluation measures. We may thus end in a cul-de-sac, that neither lost-time nor serious injuries are suitable evaluation measures! This survey study, however, focus on fatal and serious injuries, precisely because earlier studies, critical of 5-Star schemes, pointed to a discrepancy between lost time incident and fatality rates.

The second complication arises when determining the design of the evaluation study. The ideal evaluation study is one in which companies are allocated at random to either treatment or control conditions (Shannon et al. 1999). In the face of the considerable time and costs involved in setting up a Nosa system and the very large sample size required, the ideal design is clearly beyond reach.

The present non-experimental design differs in two important respects. First, that the allocation of treatment (i.e. implementation of the Nosa system) is not random. Causal inferences can therefore, strictly speaking, not be made. It may be the case that only the safer industries are attracted to the Nosa system and that this select group has a lower accident rate than the national average regardless of whether a Nosa system is in place or not. The possibility therefore remains, that the relationships reported here simply reflect some factor not controlled for. Second, that there is no well-defined control group. The Nosa companies will by virtue of their lower accident rate lower the national average, against which they are eventually compared. Using the postal survey data, the fraction of employees in the South African manufacturing sector that is with Nosa can be estimated to around 12 percent. However, the fraction of employees that are with other proprietary safety management systems of a similar type is unknown[90].

[90] Several safety rating schemes are in use in the South African manufacturing industry, e.g. Corporate Risk Management (CRM), which is affiliated to a large insurance company, International Risk Consultants Africa (IRCA), and possibly others. The market shares of those systems are unknown.

It is safe to conclude that the accident rate of the Nosa companies in principle should be compared against a rate, which is higher than the national average, although that this rate cannot be determined.

The Star rating is inversely correlated with the injury rate. There is, as noted earlier, statistical significance against the hypothesis, that the injury rates of the four Star categories be the same. Furthermore will any line drawn through the 95 percent confidence intervals exhibit a negative slope. But for both types of injury, one of the Star categories deviates from the ranking pattern. The fatal injury rate for the 3-Star category is lower than that for the 4-Star category. A possible explanation could be that 3-Star companies are less committed to the Nosa system and simply opt to abandon it if they experience a fatal injury. Those fatalities will therefore escape registration in the postal survey. Similarly is the permanently disabling injury rate for the 4-Star category lower than that for the 5-Star category.

The most prominent source of error may be associated with the fact that auditing is an entirely voluntary activity. For example, it may be speculated if companies with mediocre safety activities are more likely to opt to abandon or pause the auditing scheme in the event that they experience a (rare) serious injury. Assuming that they will generally be rated a low Star rating due to a low score on the "effort leg" they will as a group have a (biased) low number of injuries, thus distorting the predictive validity. This type of behaviour may be difficult to handle in a voluntary system without also setting strong negative incentives for mediocre bona-fide companies to embark on the system.

In the light of the mixed experiences with the US motor carrier audit scheme and the US navy facilities rating system, one could be justified in assuming that the Nosa system would perform poorly. Nosa companies constitute a far more heterogeneous group than the trucking firms audited in the motor carrier audit scheme. Above all, the two other audit schemes were mandatory while Nosa audits are voluntary. The voluntary element opens for various types of company opportunistic behaviour, for instance, including abandoning or pausing the Nosa system if injuries occur.

In this light, the Nosa system is not doing badly at all.

Conclusion

This study finds empirical evidence in support of the two hypotheses set up earlier. Two surveys studies were undertaken and both find empirical evidence that South African manufacturing companies, which were committed to the NOSA system in its 1997-1999 version, experienced fewer fatal and permanently disabling injuries than companies generally did in this sector. Overall, it appears plausible that this is due to the systematic prevention programme of the Nosa system. This supports the first hypothesis, that systematic safety management systems reduces the injury rate.

I will repeat the comment of two authors in a recent book on occupational health and safety management systems (OHSMS): "There is much testimonial support for the efficacy of OHSM systems from promoters [...] and business users [...], but *what little available empirical evidence there is* paints a less rosy picture." (Nichols and Tucker 2000:304, emphasis added).

Findings from the present study refute this negative portrayal of OHSMS. Previous empirical evidence has been scanty and some of the statistical reasoning in earlier critical studies is open to criticism. Returning to the overall purpose of this PhD study, it follows from this conclusion that integration of OHS issues in CP projects at the level of methodology is a viable approach.

The postal survey study also finds an inverse correlation between the Star rating and the accident incidence rate. Companies with high star ratings have lower fatal and permanently disabling injury rates than companies with low star ratings. The fact that auditing is an entirely voluntary activity is, however, likely to distort the Star rating to some extent. For example, it is speculated that some companies may abandon or pause the auditing scheme if they experience too many injuries.

However, the finding support the second hypothesis that safety performance indicators can be devised, which show improvement in process rather than outcomes. The implication of this conclusion is that it is a viable approach to define proactive OHS process indicators in the Danced project document (PD) as part of the LFA activity.

Methodological problems in evaluating accident prevention programmes abound. However, the major conclusion of this comparative study is that there is more and better evidence for the position that 5-Star safety rating systems lower the accident rate, than for the position that they have no discernible effect on accident rates.

Participant observation of the Nosa audit activity

After my attention had been brought to the Nosa system during the visits to the fish industries, I wished to gain further insights into the workings of the Nosa system. I therefore took contact to the Nosa branch office serving Greater Johannesburg, an area with an extensive and highly heterogeneous industrial representation. I asked the branch manager if I could join some teams of auditors as an observer during the audit session. The branch manager was forthcoming and after an introductory meeting where I presented my study, he arranged for me to join some of his auditing teams. This participant observation activity eventually convinced me that it would be worthwhile to carry out the quite time consuming activity of running the two surveys, documented above.

I sat in as a participant observer during four audits carried out by four different audit teams. The auditing team generally consisted of two persons, a lead auditor dealing with occupational safety, and an occupational health practitioner, auditing the company health records. On one occasion, a third person joined the audit team. This was an experienced lead auditor who should evaluate the performance of a newly trained auditor candidate. On another occasion, a small company was audited by one auditor only. Three of the audit sessions took two days, the audit of the largest company took three days. The four companies being audited employed from 50 to 500 employees, the average size was 275. They were producers of foods and chemicals. Three of them were five Star companies, one was four Star. Prior to the audits I signed a letter of confidentiality, that the identities of the companies would not be disclosed.

Participant observation is a rich source of information gathering. It is outside the scope of this report to discuss this activity in detail and only one issue will be covered here. Why do companies chose to be audited by Nosa? What benefits do they perceive, and how do they use their Star rating?

Earlier critique, in particular the one by Eisner and Leger (1988b), had suggested that some sort of collusion took place between management and the auditing team, and that this biased the audit in favour of the company.

I was therefore somewhat surprised to discover, that in several instances the Nosa auditors were not particularly warmly welcomed by the company anchor representatives, principally the Safety Officer. It was not just due to the audit activity being disruptive, stealing two or three days out of their otherwise busy working schedules. On several occasions during the audit activity the company safety officers complained that the Nosa requirements were unreasonable, rigid, unnecessary, or bureaucratic. Some complaints concerned requirements to written documentation, others concerned whether additional studies were necessary, 'you didn't require that study last year, so why penalise us now?'. However, most complaints concerned how to register the number of disabling incidents (DI). All companies had experienced 'freak' incidents, which they contested if should be included in the DI count. In one instance, an employee injured his knee in an informal soccer match during the lunch break. In another incident, an employee sitting in the cargo area of a pick-up truck lacerated a finger, having it trapped when closing the flap. He was off-duty, on his way home, the incident happened outside company premises but on a truck provided by the company. His injury was treated by the company nurse. It was my impression that sort of a game played itself out: if we whine and moan will you rate us more favourably? However, it was obvious that the Star-rating mattered to them. The Nosa audit was requested, not by the safety officer, but by top management, and the safety and the operating departments were in fact having kind of an unpleasant yearly safety 'exam'.

In one instance, the audited firm was part of a large company group, and it was the board that requested that all its production sites were Nosa audited. The general manager for that site attended the audit meetings for the two full days. He told me that if they experience a Nosa DI, he must answer in person to the board what happened and what corrective action have been taken to prevent recurrence. He looked disturbed when telling me so. His full two days attendance shows that the outcome of the Star-rating was important to him.

On two occasions, it came to my attention that company representatives attempted to hide issues from the Nosa auditors. At one company, I learned that two contractors had been killed in an accident about 15 months earlier. The Nosa auditors are only looking at the accident history of the last 365 days, hence they were not formally entitled to be informed about this accident. That this information was not disclosed to the auditors indicates that the safety officer feared that the information might influence the audit result unfavourably. The general manager attended the debriefing session on the last day of the audit. His opened the debriefing session with some general remarks on the importance of high safety standards, referring to 'the earlier very unfortunate events, as you know'. The general manager's statement shows that he was not part of the plot to conceal this information from the auditors. The auditors did not follow up on his vague remarks, and the safety officer's chancy plot concluded successfully.

On another occasion, the auditor suspected that some records were fabricated, he told me after the audit. He also suspected that 'something was wrong' with certain parts of the safety management system, while unable to point to specific evidence. I generally shared those suspicions. He had therefore penalised the company on some of the point scores, he told me.

Observations during the participant observation activity therefore suggest that a major motive for undertaking a Nosa audit is that 'upper management echelons', be it a distant board, or be it top management at the site, desire an independent assessment of the OHS performance of that site. Hence, the major role of Nosa auditors is to provide independent auditing services of OHS performance, providing information that eventually finds use in standard corporate superior-subordinate control and accountability mechanisms. In addition to provide a methodology for OHS prevention, the Nosa system also serves to establish a legitimate auditing framework. Ideally, companies are audited according to a standardised protocol in which requirements are fair, objective, transparent and the audit result is expressed in an easy to comprehend Star-scale, which is comparable across companies and time.

For all the companies I have visited in South Africa, I only found one instance where the Nosa system was used to control the safety of suppliers and subcontractors. This was in the case of Sasol, a very

large chemicals-from-coal conglomerate, which had recently undergone a major organisational change, involving restructuring and downsizing of the organisation. I interviewed the safety manager[91] of Sasol, in an activity not related to the Nosa auditor participant observation activities. Many of the services such as cleaning, maintenance, repairs, and small construction activities were being outsourced to a swarm of newly formed small companies, he said. There were fears that outsourcing would compromise safety. Sasol consequently requested that all subcontractors had to maintain a 3-Star Nosa rating in order to be eligible for business.

Whilst many Nosa officials claimed that a 'satisfactory' Nosa Star-rating (three Stars) was a common business relation requirement, they could not name any specific instances where this was the case, and I only found one instance of such a requirement. Consequently, the motive for seeking a Nosa certification appears to be essentially different from what is the case in ISO quality management certification schemes.

Attitudes and Star-rating

Introduction and methodology

Participant observation is a method often used to gain new insights and to generate hypotheses. In this study, the principal objective of the participant observation was to make a decision whether or not to initiate the much more time consuming task of undertaking a quantitative survey study. However, as a side benefit, the participant observation activity also led to the formulation of a number of broadly worded hypotheses. For instance, although one company[92] had suggested to me that they were surprised with their recent Star-rating, which took them from four to five Stars, because they felt they really weren't that safe, I generally had the impression (hypothesis) that companies felt that the quality of the audit was fundamentally sound and that they accepted Nosa's rating of their preventive safety efforts as being fair. A second hypothesis was that strategies, which emphasised safety through behavioural modification, were quite widespread. A third hypothesis was that companies with good safety performance appeared to have better relationships with the workers that those with poor safety performance.

While it would be a major task to test the hypotheses empirically in a rigorous manner, a postal questionnaire survey could a least give a preliminary indication of the relevance and bearing of these hypotheses. In any case, the carrying out of a major postal questionnaire survey is a very time consuming task in itself. The

[91] Interview with Safety Manager Hennie Kruger, Sasol Chemical Industries, June 20, 2000.

[92] For sake of completeness, this information does not originate from of the participant observation activity, but from an interview with the production manager during one of my other factory visits.

marginal effort in including a small section of attitude questions would be small, but the marginal benefit could be large, easily outweighing the additional effort.

The prime concern guiding the development of the questionnaire instrument was the response rate. Postal questionnaires can have appalling response rates, 20-30 percent are not uncommon, which directly threaten the external validity of the study. In the case of this particular study, it would further threaten the main objective of testing the two major hypotheses regarding the effectiveness and auditability of systematic safety management system, because a large number of accidents (i.e. a large sample) was required if the statistical tests should have a reasonable chance of attaining significance[93]. The pilot test phase of the questionnaire had clearly indicated that the questionnaire had to be short if the respondent should not feel the task of completing it insurmountable. The front page of the postal questionnaire was therefore devoted to information regarding the companies' Star-rating and accident experience. On the questionnaire's back page, 25 attitude statements could be crammed in, still keeping the entire questionnaire on one single sheet of paper, which was considered an essential requirement.

The attitude statements were worded as concise assertions, for instance, one statement reads "Safety works until we are busy, then other things take priority". The respondents would mark the extent to which they agreed or disagreed with that statement using a four-point Likert scale: disagree, mostly disagree, mostly agree, and, agree. A "Don't know" option was provided for all questions and statements in the questionnaire.

Due to space limitations this discussion will be confined to the following 15 questionnaire items, grouped into six general categories.

[93] The general problem of type-2 errors in hypothesis testing is a key issue unaccounted for in the earlier studies, critical of 5-Star systems (see Hedlund 2001)

General variables	
SIZE	Average number of full-time employee 1997-1999 (computed value)
STARS	Average Nosa Star-rating 1997-1999 (computed value)
YEARS	How many years have you been with this company? (tenure of respondent)

Familiarity with systematic management techniques	
ISO9	Is your site certified to the ISO 9000 series?
ISO14	Is your site certified to the ISO 14000 series?

Relationship with safety representatives	
Q10	It is difficult to find employees who will elect for safety rep
Q16	One of the Safety rep's tasks is to enforce safety rules - e.g. the use of PPE[94].
Q27	Safety reps mainly communicate issues to the shop floor, they don't convey much information back from the shop floor

Attitude to Nosa system	
Q12	We could hide a sensitive safety issue from a Nosa auditor, if we wanted to do so
Q15	Compared to other companies with a similar number of Stars, we are in the better half
Q21	Our customers want to know our number of Nosa Stars
Q28	Top management would take serious action if we were to lose a Nosa star

General workplace relations	
Q32	At our site, relations between management and workers have improved over the last 3 years
Q33	The relation between management and labour at our site is an us-and-them relation

Overall attitude to safety	
Q34	Safety works until we are busy, then other things take priority

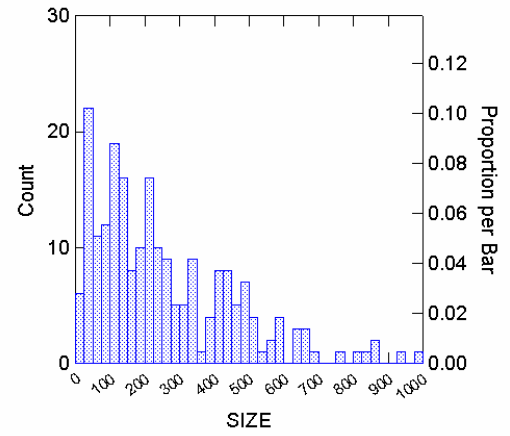
[94] PPE – personal protective equipment

Results

The distribution of average number of full-time employees in the responding Nosa companies peaks at about 100 employees. The median computes to about 210 employees (Figure 33).

SIZE Average number of full-time employees 1997-1999

Histogram



Cumulative histogram

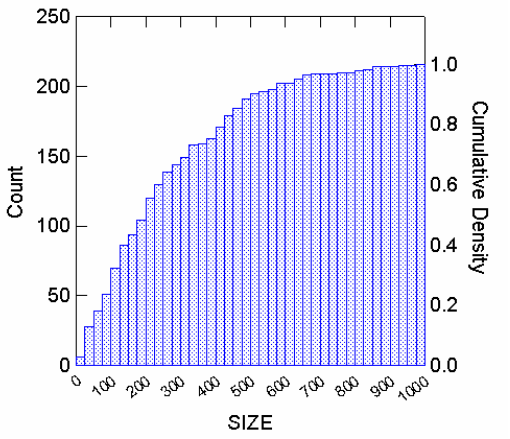


Figure 33 Size of Nosa companies

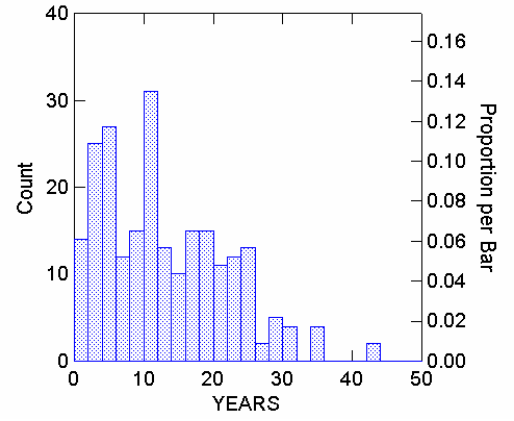
Median= 212, Mean=.431 Histograms exclude 17 companies with more than 1,000 employees.

Source: Postal survey questionnaire results (n=234 Nosa companies)

Median tenure of the respondent is 10 years (Figure 34). Less than 20 percent of the respondents have a tenure of 0-4 years, which is reassuring. A large number respondents with a low tenure could compromise the validity of the injury figures reported in the questionnaire, as the respondents would have no personal knowledge of incidents that had happened early in the three years period.

YEARS How many years have you been with this company?

Histogram



Cumulative histogram

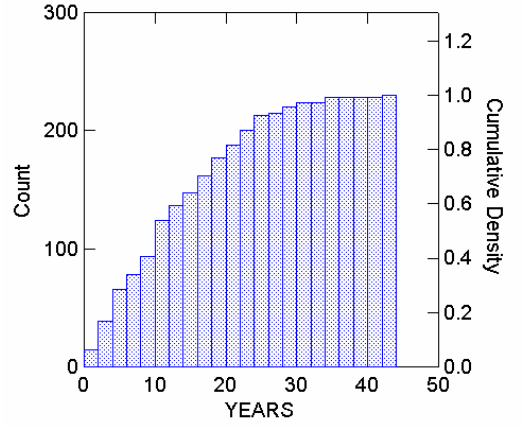


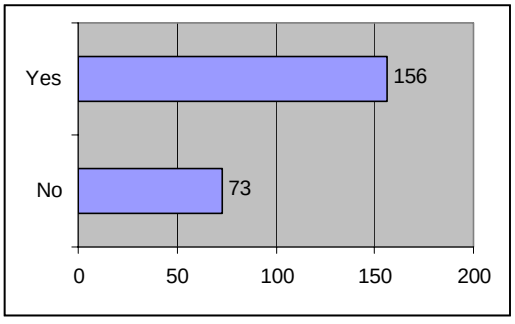
Figure 34 Tenure of questionnaire respondent (most likely the Safety Manager or Officer)

Median= 10 years, Mean=.12.6 years

Source: Postal survey questionnaire results (n=234 Nosa companies)

The companies are quite familiar with systematic and formal management systems (Figure 35). About two out of three companies are certified according to the ISO 9000 series quality management standard. About one out of seven companies are certified to the ISO 14000 series environmental management scheme, a quite high number.

ISO9 Is your site certified to the ISO 9000 series?



ISO14 Is your site certified to the ISO 14000 series?

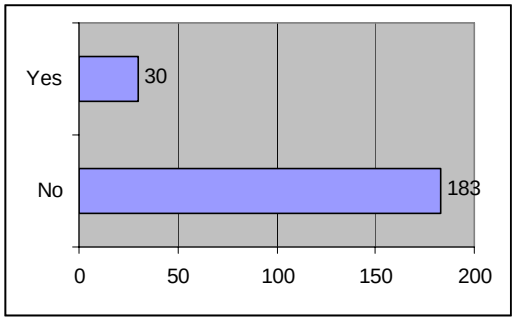


Figure 35 The use of other systematic management techniques by Nosa companies

Source: Postal survey questionnaire results (n=234 Nosa companies)

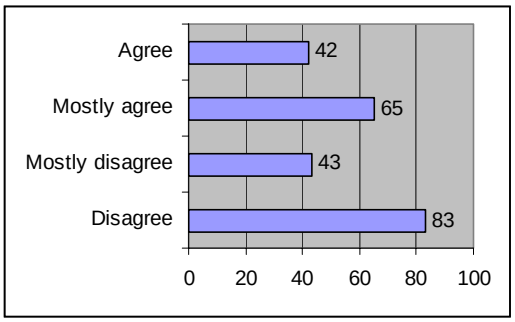
In the brief discussion of the responses to the attitude statements that follows below the four response categories have been collapsed into two. The two 'agree' and 'mostly agree' response categories have been aggregated into one single 'agree' category, and likewise for the 'disagree' categories.

Answers to statements related to the attitude to safety representatives and to the nature of workplace relations (adversarial or co-operative) are shown in Figure 36. In statement Q10, slightly less than half (46%) of the respondents agree that it is difficult to find employees who will elect for the safety representative position. Difficulties in finding employees for this task may reflect that management are not genuinely interested in safety, i.e. indicative of poor safety performance, or it may simply reflect an overall poor working relation between management and labour. It could however, also be hypothesised that difficulties in finding employees who will elect for the safety representative position could result if they were given the burdensome role of policing compliance with company specific safety rules. Statement Q16 deals with this policing issue, if one of the safety representative's tasks is to enforce the use of personal protective equipment (PPE). Answers to this statement may also indicate the extent to which companies rely on a behavioural approach to safety. A 68% majority of the respondents state that safety representatives are indeed given this wearisome task. Statement Q27 deals with the issue of poor communication, here defined as one-way relaying of information from management to the shop floor. If communication were bi-directional, safety representatives could be expected to have some influence in decisions. A 67% majority of the respondents stated that communication is bi-directional, that the safety representative also conveys information from the shop floor and up to management. Yet, a considerable minority of 33% conceded that the flow of information is mainly a one-way affair, from management to the shop floor.

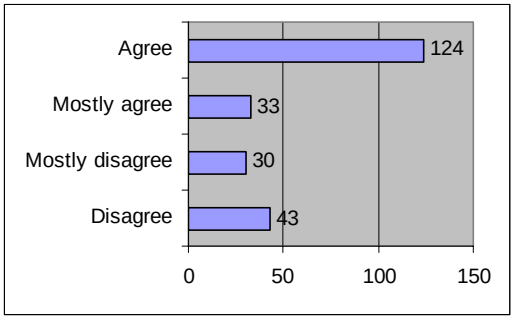
Answers to statements Q32 and Q33 indicate that workplace relations are becoming less adversarial in the post-apartheid era. Close to 3 out of four respondents acknowledge that relations between management and workers have improved over the last three years. In addition, two out of three companies disagree with the statement that the type of interactions between management and labour are an *us-and-them* relation.

Statement Q34 was intended to probe the overall attitude to safety. Companies with a superficial or a non-genuine commitment to safety would be expected to answer affirmatively to the question "Safety works until we are busy, then other things take priority". The majority (67%) of respondents disagree with this statement. Still, a considerable minority of one out of three respondents concede that this is the case, perhaps reflecting a sizeable element of cynicism on the part of the respondent.

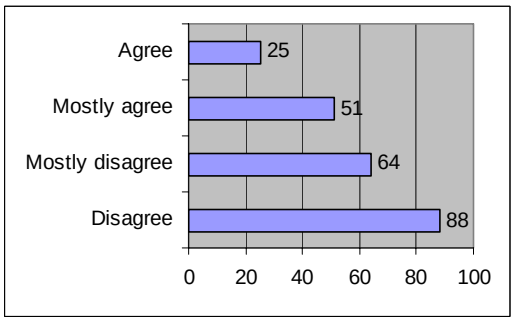
Q10. It is difficult to find employees who will elect for safety rep



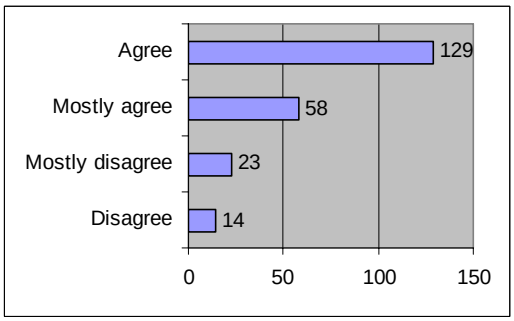
Q16 One of the Safety rep's tasks is to enforce safety rules - e.g. the use of PPE.



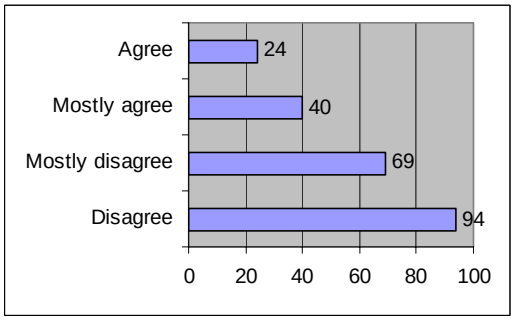
Q27 Safety reps mainly communicate issues to the shop floor, they don't convey much information back from the shop floor



Q32 At our site, relations between management and workers have improved over the last 3 years



Q33 The relation between management and labour at our site is an us-and-them relation



Q34 Safety works until we are busy, then other things take priority.

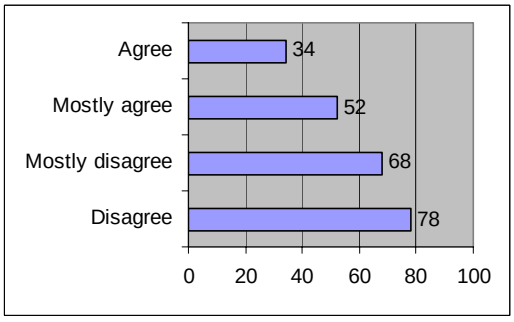
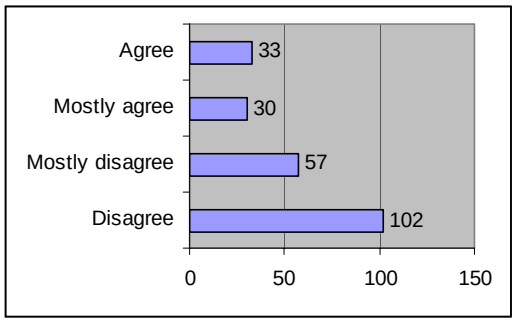


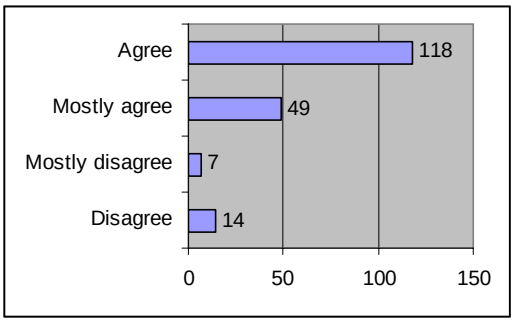
Figure 36 Attitude statement regarding safety representatives, workplace relations, and general attitude to safety.

Source: Likert scale answers to attitude statements in postal survey questionnaire results (n=234)

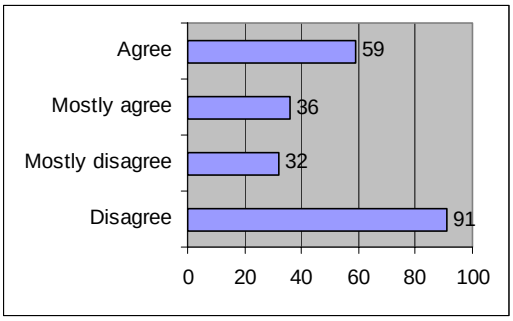
Q12 We could hide a sensitive safety issue from a Nosa auditor, if we wanted to do so



Q15 Compared to other companies with a similar number of Stars, we are in the better half



Q21 Our customers want to know our number of NOSA Stars



Q28 Top management would take serious action if we were to lose a Nosa star

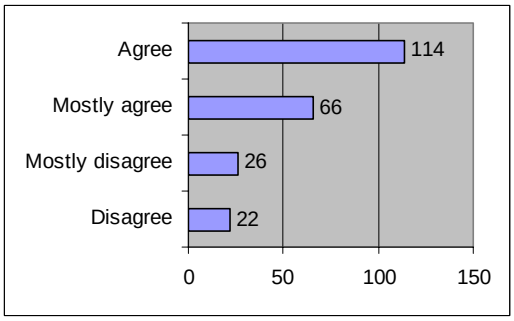


Figure 37 Attitudes to the Nosa system

Source: Likert scale answers to attitude statements in postal survey questionnaire results (n=234)

The respondents generally appear to have a positive view of the diligence and thoroughness of the Nosa 5-Star system (Figure 37). A majority (72%) of the respondents disagree with statement Q12 that they could hide a sensitive safety issue from a Nosa auditor, if they wanted to do so. This interpretation is supported by the answers to statement Q15, which reads: Compared to other companies with a similar number of Stars, we are in the better half'. If a high Star-rating were perceived difficult to achieve, companies would consistently feel that they were under-rated relative to their actual performance, and consequently, that they would be in the 'better half''. Close to 90% of the respondents believe that they are in the better half.

Several Nosa officials claimed to me that a satisfactory Nosa certification was a major requirement in some business relations, similar to the kind of supply-chain pressure that drives ISO certifications. Answers to statement Q21 offer some support to this view. A narrow minority (44%) of the respondents state that their customers do enquire about their Nosa rating. This is not necessarily

contradicting the information gathered during the participant observation, in which the key driver to certification was upper management interest. Requesting information about a company's Star-rating does not necessarily imply that the information will influence business relations. But the responses indicate that there are some customer pressures for embarking on the Nosa system.

Is the Nosa Star-rating important to top management? Answers to statement Q28 suggest that this is the case. Almost four out of five respondents expect that top management would take some sort of 'serious action' if they were downgraded one Star.

Correlation coefficients were computed to reveal significant associations between postal questionnaire variables. Likert scale answers are non-parametric variables, its makes no sense to do arithmetic on them -- an 'agree' answer compared to a 'mostly agree' answer does not represent '25 percent more agreement' with that statement.

Consequently, non-parametric (Spearman) correlation coefficients were computed based on a ranked data set. When the rank of the data, rather than the absolute value, goes into the statistical computations, the absolute value of the correlation coefficients have no longer any meaning. Only the correlation coefficient's sign value and the extent to which it is significant, matter. That two variables have a significant positive correlation coefficient means that respondents tended to provide answers in tandem, i.e. if a respondent marked an 'agree' answer to the one statement, the answer to the other statement was probably also an 'agree'. Likewise, if the coefficient is negative, an inverse association exists: i.e. an 'agree' answer to the one statement is likely followed by a 'disagree' answer to the other.

Computed Spearman correlation coefficients are presented in Table 19 overleaf.

	SIZE	STARS	ISO9	ISO14	YEARS	Q10	Q12	Q15	Q16	Q21	Q27	Q28	Q32	Q33	Q34
SIZE	1.00														
STARS	0.11	1.00													
ISO9	0.14 *	0.07	1.00												
ISO14	0.20 **	0.20 **	0.09	1.00											
YEARS	-0.04	0.26 ***	0.11	0.01	1.00										
Q10	0.02	-0.08	0.03	0.01	-0.09	1.00									
Q12	0.07	-0.03	0.02	0.08	-0.05	0.05	1.00								
Q15	-0.05	0.13	0.03	0.03	0.16 *	-0.15 *	0.06	1.00							
Q16	-0.14 *	-0.17 **	0.05	-0.03	-0.16 *	-0.08	-0.03	0.07	1.00						
Q21	0.14 *	0.07	0.10	0.17 *	0.07	-0.24 ***	-0.13	0.05	0.12	1.00					
Q27	0.03	-0.13	-0.11	0.01	-0.14 *	0.24 ***	0.23 ***	0.01	0.11	-0.01	1.00				
Q28	-0.03	0.15 *	-0.08	0.09	-0.02	-0.07	-0.15 *	0.12	0.03	-0.02	0.02	1.00			
Q32	0.00	0.08	-0.10	0.07	0.00	-0.28 ***	-0.19 **	0.24 ***	0.01	0.19 **	-0.20 **	0.25 ***	1.00		
Q33	0.05	-0.03	0.05	-0.13	-0.04	0.27 ***	0.24 ***	-0.06	-0.13 *	-0.19 **	0.23 ***	-0.08	-0.44 ***	1.00	
Q34	0.06	-0.19 **	0.04	-0.09	-0.18 **	0.29 ***	0.28 ***	-0.02	-0.04	-0.17 *	0.29 ***	-0.20 **	-0.29 ***	0.38 ***	1.00

Answers were coded disagree=1, mostly disagree=2, mostly agree=3, agree=4, or, no=1, yes=2, i.e. affirmative answer coded with the higher value. Noscar was coded as 6.
Significance levels are denoted by *<0.05 (weak empirical evidence), **<0.01 (empirical evidence), ***<0.001 (strong empirical evidence)
Note that this is the result of a Spearman non-parametric correlation analysis based on a ranked data set, therefore the numerical value of the coefficients has no absolute meaning.

Two examples of interpretation: 1) STARS*YEARS coefficient is $+0.26^{***}$, this means that a high Star rating is associated with a high tenure of the respondent (safety officer), and that this association is significant at the <0.001 level. 2) STARS*Q16 coefficient is -0.17^{**} , this means that a high Star rating is inversely associated with an 'agree' indication to Q16 (One of the Safety rep's tasks is to enforce safety rules), that is, a high Star rating is associated with a 'disagree' answer to Q16. The association is significant at the <0.01 level

Source: Likert scale answers to attitude statements in postal survey questionnaire (n=234 Nosa companies)

Table 19 Correlation coefficients (Spearman) between Size of company, Star rating, and answers to attitude statements in postal questionnaire.

The correlation analysis reveals that *a high Star-rating* (STARS), and hence a better accident performance, is

- positively associated with the company also being certified to the ISO 14000 environmental management certification scheme (ISO14), the association is significant at the <0.01 level

- positively associated with a high tenure of the respondent (YEARS), the association is significant at the <0.001 level. Safe companies appear to have experienced staff in safety positions

- inversely associated with the companies' use of safety representatives to enforce safety rules (Q16), the association is significant at the <0.01 level. It appears that high Star companies are less inclined to view safety as a behavioural issue, focussing more on safe systems

- positively associated with the company's overall attitude to safety (Q34), the association is significant at the <0.01 level

Respondent who state that it is *difficult to find employees who will elect for safety representative* (Q10), also state that

- communication is poor, the flow of information is mainly a one-way affair, from management to the shop floor (Q27, <0.001)

- the general relation between management and shop floor is adversarial (Q32 and Q33), both associations are significant at the <0.001 level

- the overall attitude to safety (Q34) is poor, safety only works until they are busy, then other things take priority. The association is significant at the <0.001 level

- interestingly, the association with responses to the Q16 statement, that safety representatives should police compliance with company specific safety rules, is inverse, as was expected, but far from being significant (P=0.25) even at the <0.05 level

The significant minority of respondents (28%) that claim that they *can deceive the Nosa auditors by hiding sensitive issues* (Q12) broadly exhibit the same pattern of associations as just mentioned, with poor communications (Q27), adversarial labour relations (Q32 and Q33) and overall poor attitude to safety (Q34). All associations are significant at the <0.01 level, or better. The association with the number of awarded Stars (STARS*Q12) is slightly negative, but not significant. In short, companies that state that they can cheat the Nosa auditors also score low on safety attitude, indicative that indeed they should have a motive to try to hide things. Yet, they do not appear to

be penalised on their Star rating for their poor attitude to safety. The data therefore offer some credibility to their claim, that they are indeed able to deceive auditors.

The considerable minority of companies (33%) with *poor communications with their safety representatives* (Q27) show highly significant associations with a number of other questionnaire statements, mostly at the <0.001 level, suggesting that this subgroup is markedly different from the rest of the companies. Their answers exhibit the following special characteristics:

- They have a higher propensity to report that they have difficulties finding employees who wish to be safety representatives (Q10, <0.001),
- they appear to be in that 28% minority that believe they can deceive Nosa auditors (Q12, <0.001), hiding sensitive issues
- they appear to belong to that 17% minority of companies that state that relations with the labour force have not improved over the last three years (Q32, <0.01),
- they are also apparently in the 28% minority that indicate their workplace relations are adversarial, the relation between management and workers is an *us-and-them* relation (Q33, <0.001),
- and they are, last but not least, associated with a low score on overall safety attitude (Q34, <0.001).

The answers from this last subgroup exhibit an inverse association with at high Star-rating, that is, those with poor communications also have low Star scores. Strictly speaking, the inverse association is not significant, but it is very close (P=0.053) to attaining significance at the <0.05 level.

Discussion and conclusions

High validity and reliability are essentials of a good Likert scale (Bourque and Clark 1992:72-73). A scale is valid if it measures what it is supposed to measure. This can be assessed in several ways, for instance by seeing if scale score can predict behaviour that is assessed separately from the scale (criterion related validity), or by determining the comprehensiveness of the items of the scale relative to the universe of content which is thought to be important (content validity). Likewise, a scale is said to be reliable if it produces the same results across time (test-retest reliability) and across the order of items (homogeneity or internal consistency).

For the questionnaire instrument in use here, issues of validity have not been rigorously evaluated. Nor have reliability issue been

addressed as it would require administrating the scale to different sample groups prior to its use. With these important limitations in mind some general conclusion may be drawn from the data.

The participant observation activity led to the formulation of three broadly worded hypotheses. The first hypothesis was that companies generally felt that the Nosa audit was thorough and diligent, and that they consequently accepted the Nosa rating of their preventive safety efforts as being fair. The empirical data from the attitude survey generally support this hypothesis. Corroborative evidence for this hypothesis is also provided by the empirical data from the two surveys on the accident performance of Nosa companies. They found that the Star rating is inversely associated with the accident rate, suggesting that, by and large, the rating is fair. A minority of companies expressed that they felt they could deceive the Nosa auditors, hiding sensitive issues. The same minority appear to have a poor safety attitude score, indicative that their preventive safety efforts are lacking. Yet, their Star rating does not appear to be negatively influenced by their lacking safety efforts. The correlation analysis findings therefore offer some credibility to their claim, that they are able to deceive auditors. Hence, intentional and successful deception of auditors by a minority subgroup is a possible explanation for the imperfect relationship between the Star-rating and the accident performance.

The second hypothesis was that safety strategies emphasising behavioural modification were quite widespread. The data generally support this hypothesis. It appears, however, that companies with higher Star-ratings have a lower propensity to employ behavioural safety practices, than companies with lower Star-ratings.

The third hypothesis was that there was a positive association between safety performance and workplace relations. The data support this hypothesis, companies which score high on safety attitude also score high on non-adversarial management-labour relations.

Finally, it deserves mention that the association between Star-rating and number of employees is *not* significant. As mentioned in the chapter on the empirical field (page 16), it is generally assumed that systematic management techniques, like the Nosa 5-Star system, are attractive mainly to large companies, not small companies. The survey data largely support this assumption: the median size of Nosa companies was slightly more than 210 employees; these are certainly not small companies. There is, however, no *significant* association between Star-rating and company size. The correlation coefficient is positive (+0.11), as would be expected, but quite far (P=0.097) from attaining significance, even at the <0.05 level. A careful interpretation of that data indicates that above a certain threshold size, company size is a less important predictor for the interest in systematic management techniques.

Concluding remarks

This chapter has examined top-down systematic management approaches to OHS prevention. The immediate reason for doing so was that such approaches are extensively championed within the environmental domain. However, a paradox unfolded. While the approaches are generally considered effective and successful within the environmental domain, their application within the OHS domain has allegedly been a failure. In the pursuit of possibilities for integration of OHS and environmental issues, this paradox was an obvious candidate for closer examination.

This chapter therefore explored two themes. The first concerned the *effectiveness* of top-down systematic management approaches to OHS prevention -- seeking to answer the question: Do they improve firm's OHS performance?

The second theme concerned the ability to *measure* the quality of *proactive* efforts within the OHS domain. It was argued that traditional measures of OHS are principally inadequate, being reactive in nature and focussing on undesired outcomes. In contrast, proactive indicator would focus on upstream indicators of the process that determine these outcomes. The question was -- Can we find upstream indicators of the processes that determine these outcomes, so-called proactive OHS indicators, that are *auditable* and *certifiable*?

Answers to these two questions have relevance beyond this study's immediate research question of how to integrate OHS in Danced's cleaner production projects. Companies increasingly address OHS issues in top-down formal management systems, for instance in ISO series management schemes. In addition, there are ongoing discussions regarding the development of international guidelines on occupational safety and health management systems. Both developments are adversely affected by this paradox. Repeating an earlier quote from a recent ILO information note: "The term 'OSH management certification' covers a variety of different activities with different scopes and objectives, and *there is only limited proof of its positive results and value with regard to the prevention of accidents* and diseases and the improvement of working conditions." (ILO 2001:18, emphasis added).

Two quantitative surveys were carried out in order to evaluate the effect of a South African OHS management system. The results of this empirical work refute the negative portrayal of failure of top-down formal management systems within the OHS domain. The two surveys find consistent empirical evidence that companies that implement top-down formal OHS management systems have a reduced incidence of injurious accidents. Overall, it appears plausible that this is due to the systematic prevention programme of the management system. The empirical findings of this study therefore affirm the first question above: such systems improve firm's OHS performance. Returning to the overall purpose of this PhD study, it

follows from this conclusion that integration of OHS issues in CP projects at the level of methodology is a viable approach.

The study also finds an inverse correlation between the audit score and the accident incidence rate. Companies with high audit scores have lower fatal and permanently disabling injury rates than companies with low audit scores. However, the audit score ranking pattern is not fully consistent with accident rate ranking pattern, indicative that auditing is an imperfect activity, susceptible to distortion. Some distortion of the audit scores is likely the result of auditing being an entirely voluntary activity. For example, it is speculated that some companies may abandon or pause the auditing scheme if they experience too many injuries. Also, the results of an attitude survey point to the existence of a minority subgroup of companies, which claim that they can deceive auditors, hiding sensitive issues. The same minority appear to have a poor safety attitude score, indicative of poor preventive safety efforts. Yet, their audit rating does not appear to be negatively influenced by their lacking safety efforts, an issue which offers some credibility to their claim, that they are indeed able to deceive auditors. Hence, intentional and successful deception of auditors by a minority subgroup is a possible second source of distortion, which may explain part of the imperfect relationship between the audit score and the accident performance.

In summary, the answer to the second question is more complex. The answer to the first part of the question is affirmative. Overall, empirical evidence support that proactive safety performance indicators can be devised, which show improvement in processes rather than outcomes. Returning to the overall purpose of this PhD study, it follows from this conclusion that it is a viable approach to define proactive OHS process indicators in the Danced project document (PD) as part of the LFA activity.

The answer to the second part of the question is cautiously affirmative. It is plausible that such proactive indicators are certifiable although they seem unable to handle partial disclosure of information or wilful deception on the part of the audited entity. The audit procedure of the South African OHS management system under study has, in theory, several complementary layers of review. In practice however, it is undermined by a lack of resources, a few persons auditing complex systems of large companies in only a few days. Nor can it be ruled out, of course, that some auditors may make improper compromises, not to upset clients.

Seen in a broader context, also taking into consideration the mixed experiences with other auditing systems, notably that of US trucking firms and of US Navy shore facilities, the South African system is not doing badly at all. In particular, if taking into account that the South African system deals with a far more heterogeneous group of companies, and especially the fact that the system is voluntary, lacking formal authority and enforcement powers.

It has been argued at length in this chapter, that there is a striking similarity between present day rhetoric and approaches to environmental management, and early (1910-1930) approaches to safety management. The driver is a combination of a just cause and sound economic cost-efficiency. The methodology is top-down goal setting and implementation. The rhetoric is about improving management control over work processes. The organisational instruments are hierarchic rule and bureaucratic control. The only major difference is the concept of continuous improvement, which was only recently developed by the quality management movement.

It is therefore surprising, and intriguing, that the management system debate has been so different within the environmental and OHS domain. Within the environmental domain, there is a swell of success stories. But within the OHS domain, academics have discredited management systems, claiming that they have no discernible effect on accident rates -- conclusions that have been based on surprisingly little empirical evidence, unsound statistical reasoning, and remained unchallenged for over a decade.

A possible explanation may be that the top-down management systems have no particular provisions for employee participation, which for decades has been a key OHS strategy in a number of countries. This study will not enter further speculations regarding participation. The South African setting represented a unique opportunity to test the effect of top-down management systems empirically. Due to South Africa's troubled recent past, the setting is less ideal to test empirically the effect of participation. A discussion of issues that have not been covered should also mention that the issue of *efficiency* of top-down management systems has not evaluated. That is, the outcomes seen relative to resources spent. This study has only dealt with *effectiveness*, that is, the ability to achieve a desired outcome. While obviously relevant, the issue of efficiency is only of secondary importance, only meaningful of study if effectiveness has been demonstrated.

The earlier chapter gave extensive consideration to whether behaviour and outcomes should be interpreted in a rational context, a context of bounded rationality, or both. While slightly outside the scope of this chapter, this dichotomy can also be applied to (rational) top-down management systems. In short, the question is: What processes, initiated by the management system, are responsible for the outcome in terms of improved OHS performance?

A rational interpretation would focus on processes of identification of inventory of problem, problem selection, identification of range of solutions, selection of solution, and implementation. For instance, a survey of machinery could identify a problem of unguarded moving mechanical parts in the workshop. Management might therefore decide to embark on a machinery guarding program for the workshop lathes. Mechanical safeguarding of lathes has been shown empirically

to reduce the number of occupational accidents with lathes (Varonen 1995). Hence the safety program's positive impact on the accident rate could be explained in terms of this rational choice series of events.

However, an alternative explanation invoking the model of bounded rationality is offered by Gray and Scholz (1993:199-200). They note that even the best-intended citizens have difficulty of learning the multiple demands that socially desirable laws impose on them amid the 'boomin-buzzin' complexity of modern life. Safety demands compete with a cacophony of other demands and persuasive communications that attempt to change the citizen's behaviour. In this context, an external safety auditor or a company internal safety officer may help managers or decision makers by interpreting their duties. In concrete situations they can point out discrepancies between actual safety prevention efforts and prescribed ones and suggest behaviour that is more consistent with beliefs and obligations. In this manner, the safety auditor or the safety officer may help focus (or refocus) the attention of managers on OHS problems that have been overlooked or ignored. This attention may even trigger a broader review of performance that goes beyond the initial discrepancy

This alternative view lends heavily from March's ideas of bounded rationality and of satisficing and rationing of attention (see page 64). In theories of bounded rationality, attention is the scarce resource. There are more things to do than there is time to do them. There are more claims on attention than can be met. In this framework, behaviour and decisions are best understood from the processes of allocating scarce attention and of the conditions under which the search for solutions is triggered or stopped.

The company will usually have a safety officer to run the Nosa system. The safety officer may influence the way a manager's attention is allocated to OHS problems and hence the priorities of safety work. The effect of the Nosa system may in this framework be from the activities of this person. This would be consistent from the finding from the US motor carrier audit scheme in which Moses and Savage (1992) found that the appointment of a safety director was strongly related to accident occurrence (see page 185). It may also be part of the explanation for the positive association between a high Nosa Star rating and a high tenure of the respondent, which was in found in the attitude statements analysis above.

The implication that follows from the recognition of attention as the key scarce resource is that part of the effectiveness of safety management may stem from the allocation of time and attention to a specific set of issues, that it entails, rather than the more concrete nature of the tasks and issues of the safety management system.

Chapter 8.
The Durban Club study

Introduction

The previous chapter examined top-down systematic formal management approaches to OHS prevention. These formal approached tend to have appeal mostly to the large companies with professional management. 'Large' companies are here characterised as those companies where the equity holder has contracted with an agent to run the company on his behalf. Management structures in these large companies tend to be hierarchic and bureaucratic with well-defined areas of responsibility compartmentalised into a number of staff functions, for instance a general manager, a production manager, etc.

This is in contrast with small companies, here characterised as those where one individual, usually the owner, handles the majority of the day-to-day issues of the business. In this chapter, this person is often referred to as the 'owner-manager'. This chapter will argue that lack of time on the part of this individual and the large number of very different issues that constantly compete for his attention are important features that help to explain and understand the behaviour of this group of companies.

Top-down systematic formal management approaches to OHS prevention have little or no appeal to owner-managers of small companies. A considerable body of literature suggests that owner-managers of small companies generally view authorities and consultants with mistrust, that they perceive systematic methods to be overly complex; written material is often not read and has generally little impact. Interventions in this segment of companies are therefore generally considered to be complex and difficult[95].

Yet, the ability to effectively target precisely this segment is becoming increasingly important. There is rising evidence of a large-scale, perhaps global, restructuring taking place in which large companies downsize, outsource and subcontract. This restructuring has contributed to a substantial increase in the proportion of small and

[95] Sacob (2000). Tait and Walker (2000). Limborg and Hasle (1996), Gombault and Versteege (1999)

medium-sized enterprises[96]. Discussion in an earlier chapter (page 100) pointed to evidence that a similar development is currently taking place in South Africa. Competitive pressures can lead to corner cutting of OHS standards. Small and medium sized enterprises may be particularly vulnerable as they often lack the resources, sophistication and motivation to attain minimum legal standards[97].

There is a large turnover of small firms every year and the average small firm may expect its life-span to be short.. In the UK, the average life-span is about 5 years, up to 400.000 new businesses start out and similar numbers cease operations each year; hence longer-term planning, investment and staff training has a lower priority. Evidence in the UK is that small firms experience much higher accident rates than large enterprises. A study of injury rates in manufacturing shows that the rate of fatal injury and of amputation injury in small manufacturing workplaces double those in large workplaces[98].

This chapter discusses and reports some findings of an intervention in small and medium sized companies. It hereby complements the discussion of the previous chapter, which dealt with large companies. The different empirical field has lead to a different research strategy bearing more on the action research tradition. Reference is made to Chapter 2 for a discussion of research traditions, the underlying epistemological considerations and methodological implications. The choice of research tradition has influenced the descriptive and narrative form of this chapter, which holds many references to my personal impressions and judgements, often worded in the first person, singular, grammatical tense.

This chapter will first describe a cleaner production intervention in the metal finishing industry of Durban, South Africa, an industrial sector in which small companies prevail. The intervention was of an experimental nature, set up to examine if a networking approach developed in Europe in the 1990s could be successfully transferred to the South African setting. The intervention concept is that a limited number of companies form a Club in which they share information and experiences regarding preventive approaches to pollution.

Much in the same vein as the previous chapter, this chapter will then identify and describe an earlier OHS intervention concept, developed

[96] UK figures illustrate this development. By the late 1990, 99 percent of all firms employed fewer than fifty people. These firms accounted for 44 percent of total private sector employment, compared to 35 percent in 1979. (Gunningham 1998:204). In the United States almost 98 percent of businesses have fewer than 100 workers with 56 percent of the workforce employed in those businesses. In fact, 86 percent of US business establishments have fewer than 20 employees and employ about 26 percent of the private sector workforce Jones (1999).

[97] A good discussion is provided in Mayhew and Quinlan (1997), Quinlan and Mayhew (1999), and Quinlan (1999).

[98] The factual information is from Clifton (2000). Nichols et al. (1995) voice similar concerns, small is not beautiful, they say -- small firms have worse accident rates and-worse industrial relations.

in the 1980s under the auspices of the International Labour Organisation. The main argument of the chapter is that those two concepts share so many similarities that the conditions are met for a successful integration of environmental and OHS issues. It is also argued, however, that the two concepts share the same vulnerabilities.

The experiences of the Club intervention, as I view them, are finally examined in the perspectives of two competing theories, that of rational choice and that of bounded rationality[99]. Both the Club concept and the ILO concept are informed by rational choice theory. But this chapter argues that valuable insights into company decision-making behaviour can be gained if it is assumed that attention is the key scarce resource, and if the decision making process is viewed as a strategy of satisficing. The main implication of this, the chapter will argue, is that the effectiveness of the interventions is greatly enhanced if they are backed regulatory action, or a credible threat of regulatory action.

Finally, I wish to stress again that the term 'non-professional management' refers to the management *structure*, not to the aptitudes or competencies of the owner-managers of small firms. Running a business with, say, 50 employees is an extraordinarily complex task. The owner-manager must deal with a diverse range of issues from production planning, personnel management, customer relations, product quality checks, strategic market decisions, investment and financing decisions, and others. Doing this is no small task, doing it successfully is no small achievement. The owner-managers that I met were clever, charming, sly -- in short, unique characters of great capacity.

[99] The reader is referred to an earlier section on page 61 and onwards for a discussion of rational choice and bounded rationality.

The Waste Minimisation Club

Events leading to the formation of the Club

There are about 90 electroplating operations in Durban, many of them small operations, the owner typically having an artisan background. They are operating in a competitive jobbing market and are not organised in any type of industry association.

In the late 1990s the Durban municipality had a problem with the sludge from its waste water treatment works. The concentration of heavy metals in the sludge exceeded the limits set by the central government in Pretoria for bringing the sludge to grassland. This non-compliance created administrative and other problems for the municipality's sludge disposal practice. Alternatives to the grassland disposal route were not attractive to the municipality, partly because the costs would be higher.

The municipality undertook an analysis of the possible sources of the heavy metals that ended up in the sludge. This analysis identified the metal finishing industry as a significant contributor of pollution, in particular were companies with electroplating operations singled out. In order to curb those emissions, the municipality embarked on a campaign in which effluent standards were tightened[100]. The new effluent standards would effectively require that companies install advanced effluent water treatment plants with a chemical precipitation of dissolved metals process step.

The new effluent standards outraged business owners who felt that the requirements were so stringent that they could not be complied with, even if costly effluent treatment plants were installed. Business owners with electroplating operations therefore feared that they would be forced either out of business or out of town. Business owners were also angered with the autocratic and unilateral manner in which the municipality had acted. No consultation with the industry had taken place.

In an unusual step for this highly fragmented industry (see page 148), some company owners organised a mass meeting inviting all affected companies and the municipality to attend. The purpose of the meeting was that the industry should protest and challenge the municipality's

[100] Actual effluent concentration limits are defined in bylaws by the local authorities that operate the local sewage treatment works. This provides some decentralised decision-making, permitting local authorities to consider special local conditions. Examples: For the New Germany industrial area, which is located some 20 kilometres inland and discharges to river systems, the new general concentration limit for metals (Cu, Ni, Zn, Pb, Cd, Hg) is 5 mg/l. For the Durban area, which is much closer to the Indian Ocean and has larger treatment works with a higher proportion of non-industrial sewage water, the new limit for Cu, Ni and Zn is 50 mg/l; the limit for Pb and Cd is 25 mg/l, and for Hg it is 1 mg/l (Durban Metro 1999, table 1)

decision in a unified manner. At this meeting, which was described to me as being "stormy", Prof. Buckley from the Pollution Research Group of Chemical Engineering, University of Natal, Durban, stood up and spoke in favour of starting a Waste Minimisation Club (WMC) project. The main argument for the WMC was that a swift legal move to mandate end-of-pipe (EOP) effluent treatment measures was likely to be not only premature but also excessively costly; both to the industry of which some would be forced out of business, and to the society in terms of lost employment. Mr. Buckley believed that there was a considerable potential for pollution prevention at the source and argued that, for sake of overall efficiency, mandated EOP measures should only be considered after source reduction through pollution prevention techniques had taken place. The WMC concept had been applied successfully in UK industries, he argued, and it deserved to be tested in South Africa as well.

At the same time, but unrelated to the municipality's sludge quality problems, another serious problem to Durban's metal finishing industry evolved. Due to heavy rains and perhaps aggravated by improper construction practices, Durban's only hazardous waste landfill site experienced a landslide. The landslide immediately closed the landfill operation and there was no available estimate of when the site would re-open, if ever.

Several of the metal finishers, who were disposing off sludge and other solid waste streams to the landfill site, now had to look for alternative means of disposal. The only immediate option was bringing the waste to an inland hazardous waste landfill site near Johannesburg, some 700 km away, in another Province. Transportation costs were, however, prohibitively high. Some business owners also felt that bringing hazardous waste across provincial borders would be impossible in the longer run due to expected public protests, if the transports became known in wider circles in the receiving Province. With no attractive solution to these disruptions within immediate reach, many of the metal finishers simply started to accumulate solid waste at their premises. The situation was clearly unsustainable.

The closure of the Durban hazardous waste landfill site also interfered with the municipality's plans of mandating effluent water treatment plants. All effluent treatment plants produce waste streams, notably sludge from the chemical precipitation of dissolved metals. Some of those sludges were classified as toxic or hazardous, either due to the nature of their metal contents, or due to the nature of the upstream chemical electroplating processes. This is a particular problem for companies with cyanide electroplating technology, where toxic cyanide compounds can find way into the sludge. Company owners felt it was unfair if the municipality on the one hand mandated effluent treatment plants, and on the other hand did not provide a disposal route for the sludge that these effluent plants generate.

Eventually, a quid pro quo arrangement was outlined. The municipality should delay its mandated effluent treatment campaign for one year. In return, the industry should start a Waste Minimisation Club (WMC), embark on a waste minimisation programme and generally prepare themselves for tightened effluent standards to come.

The WMC concept and its origins

The idea of a Waste Minimisation Club (WMC) is that a group of companies work together to reduce their environmental impact. The Club members meet on a regular basis where they exchange information and experiences related to waste minimisation. This information is often of a practical or specific nature related to financial savings from cost reductions. The social interaction in the Club is also expected to encourage club members to improve their operations, for example through reporting of the financial savings achieved since last meeting.

In short, the WMC approach aims to encourage companies to organise in an information sharing network type organisation, for which they themselves feel ownership for, driven by self-interest. The Club also provides a convenient forum for companies to 1) exchange ideas on waste reduction by networking with other companies; 2) receive training in waste minimisation methodologies; 3) in some cases, gain access to subsidised consultancy for expert help; and 4) keep up to date with new legislation (UK-DTI 1998).

The United Nations Environment Programme (UNEP) recognises Waste Minimisation Clubs as a policy instrument for promoting cleaner production (UNEP 2001).

The mid 1990`s saw the development of the Wastes Minimisation Project Clubs, a Dutch approach for industrial waste minimisation that was adopted and developed for the UK. The UK Waste Minimisation Project Clubs generally work by; linking waste minimisation goals with resource efficiency; emphasising environmental and economic benefits; using a range of cost saving measures; encouraging energy management, clean technology, process modification, re-use & recycling, and the use of alternative materials; and by disseminating practice and ideas amongst the widest possible community. As a low estimate[101], there have been around 60 such clubs across the UK, which have received support or guidance from the Environmental Agency and other UK organisations. The primary objectives of the UK Clubs have been to demonstrate the benefits of waste minimisation by linking waste minimisation goals with resource efficiency, emphasising both environmental and economic benefits. (Read 1999, 2000).

[101] Estimate provided in year 2000.(Read et al. 2000).

Experiences gained with the UK Club arrangements indicate that the participating companies are generally unaware of their waste related costs and that they largely underestimate them. For example, in one Club with ten companies, their initial perception of their waste cost was in the region of £0.5m. Yet, audits eventually showed that actual costs were 25 times higher, close to £13m, comprising almost 5% of the companies' total turnover (Read 1999). Many clubs have reported substantial waste reductions and impressive financial savings.

The success of the UK Clubs has been attributed to a number of factors. The more significant ones include the benefits of pooling and sharing practical experiences and problems, that the companies help each other, and that they feel obliged to keep to waste minimisation targets agreed to in the Club. Yet, it is also clear that the key motivating influence has been the cost savings, not the environmental benefits. (Read et al. 2000).

The Durban Club initiated

Eventually, the Durban Metal Finishing WMC was formed in mid 1998. The WMC was set up on an experimental basis, backed and anchored by researchers at the Pollution Research Group from the University of Natal (Durban). The Club project was funded by the South African Water Research Commission with the dual objective of determining the feasibility of the WMC approach in South Africa[102] and establishing the necessary criteria to replicate the Clubs in other regions. Co-funding was provided by the European Union, which allowed for the involvement of two European consultants, namely Enviros March (UK) and Cowi (Denmark).

The Club consisted of 29 companies, which included 23 electroplaters, 3 powder coaters, and 3 galvanisers. More than half of the companies have less than 50 employees. The majority (60 per cent) can be classified as jobbing shops, while the remaining 40 per cent are manufacturers where metal finishing operations form part of their production process (Barclay and Buckley 2000).

A consultant from Enviros March's UK office ran technical training courses at some of the Club meetings. The training course package comprised seven or eight modules for instance covering savings on energy and raw materials, and techniques for monitoring and targeting environmental performance. Students from the Chemical Engineering Department of the University of Natal, Durban, assisted Club members in carrying out environmental audits at the companies, including a list of recommendations for actions.

The WMC concept comprises self-sustained networking activities in which Club participants exchange ideas and experiences, combined

[102] In fact, two pilot clubs were formed as part of the project. One involving the metal finishing sector in the Durban and Pinetown areas, and one involving mainly textile industries in the Hammarsdale area.(Barclay and Buckley 2000).

with externally provided training activities, in which Club participants have access to expert advice. Different interpretations may emphasise the relative strength of either element. The Durban case employs both elements: Club members were, at least initially, clearly exposed to a substantial input of external expert knowledge.

The developments as seen from one Club member

Mr. John Danks and his partnership business

The Saayman Danks Electroplaters business has two owners, Mr John Danks in a partnership with Mr Noël Ferguson. The business is operating out of relatively modest premises in an industrial area in Durban and employ approximately 50 employees. It is a jobbing shop, providing metal finishing operations for products manufactured elsewhere. The business has a couple of volume plating lines, in particular zinc and chrome, and a diverse range of small speciality plating lines, of which many appear to have been started on an ad hoc basis in response to new customer requirements. In their own words, they can coat a product with 'any metal the customer wants', except cadmium, which they have recently abandoned.

Mr Danks has been in the electroplating business for more than 35 years[103]. He has received formal training into electroplating technology and has attended the Johannesburg Technicon, a college for technical education. He started his first plating shop in Johannesburg in 1964. Over the years he has had his own business, been a consultant for a chemical suppliers company installing effluent plants, he has sold chemicals to other platers, "that gives you a good opportunity to see the competitors factories", and is now a partner in the Saayman Danks electroplating business. In summary, Mr. Danks is an experienced plater who, unlike the majority of platers, also has considerable technical knowledge about electroplating technology.

He contends quite openly that he too has been involved in doubtful environmental practices in the past, which he says are in so widespread use in that industrial sector. According to Mr Danks, simple dilution of effluent streams to meet the municipality's concentration based effluent standards is a widespread industrial practice. So is dumping of chemicals and obsolete process baths directly to the storm water sewer system during heavy rains.

Mr. Danks has played a pivotal role in the functioning of the Durban WMC, and he has been instrumental in the wider promotion of CP in South Africa. He was a guest speaker at the LFA workshop in Pretoria, held as a part of the project preparation phase of the Danced metal finisher project (page 148) and he has spoken before audiences

[103] Self reported information. I have spoke with Mr Danks on a number of occasions, although much of the following information is from a larger interview on Oct 8, 1999.

in Cape Town, Bloemfontein, and other places. He usually speaks as a converted industrial polluter -- one who has abandoned the electroplating industry's problematic environmental practices in favour of green CP practices. He likes to reiterate the point that he would have gone out of business had it not been for the financial savings achieved though new CP practices. According to Mr Danks, the savings potential is considerable. Water savings of up to 50 percent are easily within reach simply stopping the widespread dilution practice to meet effluent standards.

Changing perceptions about CP

It was the event taking part in Durban WMC and a study tour to Denmark, which eventually changed Mr. Danks' negative perceptions of environmental issues -- the negative view that better environmental performance always comes at increased costs. This change of perception is interesting and will be described below.

At the first mass meeting where Mr. Buckley presented the idea of forming a WMC, Mr. Danks was highly sceptical about the idea. But he decided to enter for two major reasons. First, the WMC might be instrumental in gaining time, to argue for postponed intervention from the municipality. He felt that a membership of the WMC was similar to a statement of due diligence; it was an important signal to the municipality that the industry was prepared to bring order to own house. Eventually, he also hoped that the municipality's effluent demands could be softened to 'more reasonable' concentration levels through negotiation.

His second reason for entering was to be well informed and possibly to influence the process. Tightened effluent standards, which in effect would make effluent treatment plants mandatory, were not necessarily disastrous to him. His plating business was well established and financially relatively mature, probably capable of absorbing the cost from an effluent treatment plant. Many of his competitors, he reckoned, were financially in a worse condition. If new tightened effluent standards were enforced consistently across all industries in the Durban area, the net result might be a shake out of the weaker or less sincere operators, leaving him with less competition. It was this mix of strategic considerations, partly defensive negotiation and softening of the municipality's proposals, and partly offensive use of new environmental demands to strengthen own business, that informed his decision to enter the WMC.

His initial scepticism resulted from a perceived lack of professional benefit from joining the club. The most likely outcome, he thought, was that some of the more inexperienced platers would scavenge some of his plating expertise. While he would seek to limit this, he felt that it would not hurt him too much anyway, and after all, he could control the amount of information disclosed. He already ran a highly efficient

plating business, he had certainly nothing to learn from these sessions, he felt.

Not so long after the WMC was started, Prof. Buckley was able to secure a small grant from Danced for a study tour to Danish metal finishing industries that had implemented CP practices, travel and living expenses paid. Prof. Buckley asked Mr. Danks to join the small group of people comprising Prof. Buckley, Mr. Steenveld who is a senior representative from the national water research commission, Mr. Danks and possibly one or two others.

Mr Danks refers to this tour as an eye opener, a professional turning point. With a mixture of surprise and thankfulness, he said that this was first time ever that somebody had offered him "something for nothing". When he described the tour events to me, his account was particularly vivid when he recalled the visit to the Danfoss facilities in Nordborg, Denmark. The Danfoss facilities had an effluent treatment plant comprising four tanks, each tank so large 'it could hold a minibus'. The effluent plant was built before Danfoss embarked on CP practices. At the time of the visit, however, only one tank was in operation. The remaining three tanks stood idle, unnecessary because CP practices had so greatly reduced the amount of wastewater being generated.

This situation was highly relevant to Mr. Danks because he might face a similar situation at home. The Saayman Danks production site was already congested and expansion was difficult due to neighbouring businesses. New premises were needed for a new effluent plant, he believed, the only possible option being a plot across the road and uphill, requiring complex and costly piping and pumping arrangements. Perhaps CP practices would allow him to shrink the effluent plant keeping it on existing premises?

Innovative CP practices at Saayman Danks

The study tour to Denmark spurred a period where a number of innovative, simple, yet highly effective CP practices were introduced at the Saayman Danks electroplating production facilities. In the beginning, the new practices mostly involved better housekeeping techniques. For instance, installing water meters, logging and monitoring water consumption, installing small reducer valves on water taps, and checking bath conductivity to optimise rinse flows. Simple changes were also introduced to the plating process lines, for instance were wooden boards installed in existing rinse tanks to give extra rinse steps, and some counter-flow rinse procedures were implemented. While highly effective, these changes are simple and rather straightforward, and they are covered in standard CP guidelines, for instance UNEP (1989 and 1998), se example in Figure 38.

Another example of a self-invented simple housekeeping practice is a reduction in up-time of the trichloroethylene degreaser unit. This

production planning change saves energy and reduces the evaporation losses of the trichloroethylene chemical. New piping has been installed that permits the recovery of waste heat when the degreaser is in operation.

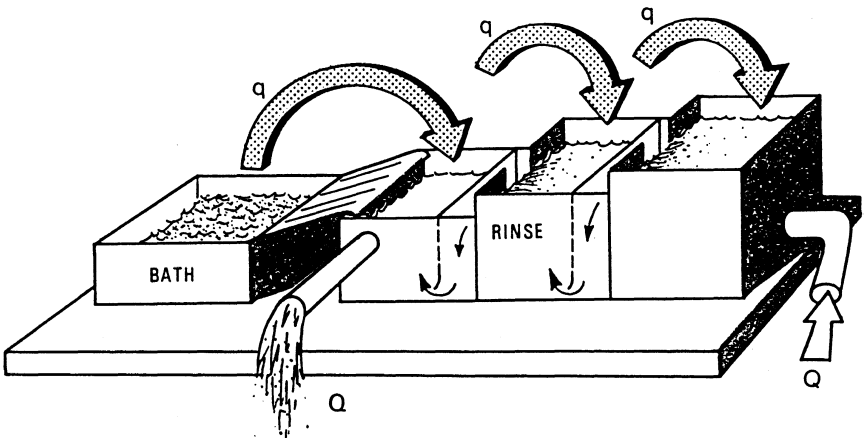


Figure 38 Schematic design of cascade rinse with three tanks as implemented by Mr. Danks

Product flow is from left to right as shown by shaded arrows (q). Rinse water (Q) runs counter flow from right to left. Note the weir arrangement that guides rinse water from the top of one tank to the bottom of the next.
The arrangement shown can dramatically reduce water consumption (up to 90 percent) while not changing the rinsing effect.

Source UNEP (1989:15-17)

The innovation at the Saayman Danks facilities went further. One example is an innovative solution to waste problems generated in the initial acid pickling process step. Before electroplating can take place, metal oxides (rust) must be removed from the product surface. This is accomplished in a 'pickling' process step in which the product is submerged in an acid bath. Traditionally, the acid of choice is hydrochloric acid. Mr. Danks decided to switch over to sulphuric acid, which pickles slower, but is cheaper. As a side benefit it does not give off obnoxious fumes as hydrochloric acid does, even when heated, alleviating an OHS issue as well as problems with corrosion of the roof structure above the bath. However, the real CP benefit arises when the bath must be disposed off because the iron concentration has become too high. Mr. Danks found a fertiliser producer who can use the spent pickling bath as a raw material in the production of a sulphate fertiliser, conditional that the bath has only pickled iron products. Mr. Danks has therefore introduced a separate tank in dedicated iron-pickling service. The waste exchange scheme is beneficial to both parties. Mr. Danks saves the cost of chemicals to neutralise the acid and the load on his effluent plant is reduced, permitting a smaller (and cheaper) effluent plant. The fertiliser producer obtains a valuable raw material at its transportation cost only. Mr. Danks has made a similar arrangement with a producer of copper

sulphate who is willing to take his spent sulphuric acid pickling bath conditional that it has only been used for pickling of copper products.

Other examples of simple yet highly effective innovative practices are found on the nickel and the chrome plating lines. On the nickel line a small additional rinse step has been introduced, in which the hangers are soaked in spent rinse bath solution. With this small change, an expensive rinse bath solution can now be used for up to 3-4 weeks before it must be disposed of due to build-up of nickel. The excess nickel on the hangers is now dissolved in the spent rinse bath solution; which has a too high nickel content to be used for rinse, but is fine for stripping excess nickel off the hangers. Previously, the expensive rinse bath solution lasted for only one week.

Figure 39 A slow hoist enhances drip off and reduces lifting strain

This example shows how an innovative, yet simple, modification improves both the environmental and OHS performance

Good drip-off of bath chemicals is essential in limiting the volume of chemicals being transferred from one bath to the next, the so-called drag-over, see page 144. Drag-over consumes chemicals, reduces bath life, requires higher rinse flows and produces more sludge in the effluent treatment plant. On the chrome plating line, which is a volume plating line, good drip-off is difficult to achieve due to the viscous nature of one of the baths. Mr. Danks has enhanced drip-off simply by installing a slow hoist made out of a spare motor and an old gear (Figure 39). Lifting the jigs slowly out of the bath provides additional drip-off time. This modification has improved drip-off over the earlier practice where the jigs were lifted out of the bath manually. The hoist was also beneficial to the operator, reducing muscle strain, because the jigs, according to Mr. Danks, are "jolly heavy".

However, in the subsequent rinse steps, the jigs are still lifted in and out of the rinse baths manually (Figure 40), indicative that OHS issues (lifting strain) have either not been considered or do not command the same attention as environmental issues do.

Figure 40 No hoist is installed in the subsequent rinse steps

Had OHS issues commanded more attention, a runner (rail) arrangement to the rinse section might have been considered.

On the zinc plating line, a new cyanide-free alkaline zinc process has replaced the traditional cyanide zinc process. Mr Danks claims to be one of the first platers in South Africa (if not the first one) who has introduced cyanide-free zinc plating. The alkaline process is more sensitive to deviations in the chemical compositions of the baths and demands more attention and plating skills. The transition was not easy but the rewards have been more benign effluent streams that no longer contains cyanide, a potent poison. The environmental impact of this change has been significant, as the zinc line is a volume plating line.

The Saayman Danks shop has moved away from cadmium plating. The decision was not trivial, as it has meant that they forego business. The profit margin on cadmium plating is also higher than for zinc plating. They have successfully convinced some customers that a special 'heavy duty' zinc plating process with chrome-6 passivation was as good as cadmium, for the intended purpose of that product.

In summary, the Saayman Danks site scores quite high on a scale measuring the extent to which the philosophy of prevention embedded in the concept of cleaner production has been embraced. Ranked on an arbitrary scale of 'increasing level of prevention' the changes involve:

1 better housekeeping (fixing water leaks, trichloroethylene unit production planning)

2 process changes (e.g. cascade rinse)

3 technology changes (cyanide-free process)

4 convincing customers to modify their products (cadmium)

5 entering into industrial symbiosis arrangements[104] (e.g. waste exchanges of spent pickling baths)

And... occupational health and safety?

It is clear, however, that no particular attention has been paid to OHS issues. They may have the fortune of piggybacking on environmental issues but are not considered separately. For instance, the change from hydrochloric acid to sulphuric acid did *also* improve the working conditions (fumes) in addition to solving a waste problem (the initiator of change) and a problem with corrosion of the roof structure.

It is also clear that the technical guidelines offer little help in that respect. Figure 41 shows an example from one of the guidelines on how rinse efficiency can be improved by air agitation of the rinse water.

The release of compressed air at the bottom of the rinse bath will, however, also increase aerosol formation above the bath, in effect making small droplets of rinse liquid airborne and breathable. While this technique may improve the rinse efficiency, it may also expose nearby operators to new risks or to more intense chemical exposure. The technical guideline gives no mention to this side effect.[105]

[104] A note on terminology: In a strict sense, the definition of cleaner production, for instance that of the United Nations, specifically excludes off-site waste recycling arrangements and possibly also industrial symbiosis arrangements, as they do not prevent pollution at the source. However, this thesis takes a pragmatic approach and treats industrial symbiosis as a further development of cleaner production, in accordance with the chronology outlined on page 12.

[105] This example is provided to make a point about sub-optimalities in general. I did observe some air agitated rinse baths in the plating shops of Club members. They were old and had been installed for technology reasons. To my knowledge no plater installed air agitated rinse bath *because* of the Club activities, as a cleaner production practice.

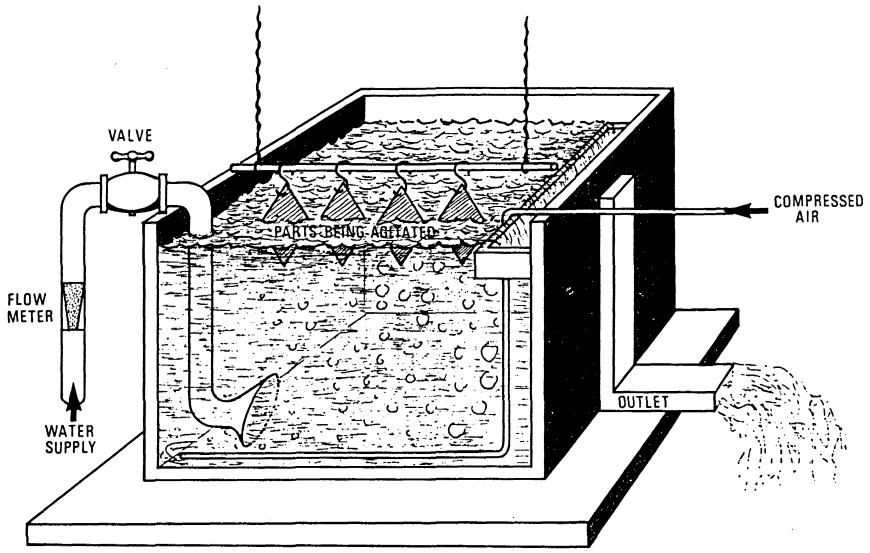


Figure 41 Rinse efficiency improved with agitation of bath with compressed air

Blowing compressed air through a bath is likely to create aerosols, in effect making small droplets of the rinse bath airborne and breathable. This example has potential for media-shifting, that improved environmental performance may lead to a deterioration of occupational health and safety performance.

Source: illustration provided in UNEP (1989:14-15)

Benefits -- and the price paid

Mr. Danks reckons that they have only picked the low hanging fruits. Most changes have been small and simple, except the process change from the cyanide zinc process to the cyanide-free alkaline zinc process, which is a technology change of a more fundamental nature. Most changes have also been inexpensive.

Yet, the financial savings have been substantial. With roughly the same production volume, the water consumption is now only 25 percent of what it used to be and the consumption of chemicals (raw materials) has been reduced by about 10-15 percent. Effluent concentrations have stayed more or less the same, perhaps slightly higher. Mr. Danks reckons that the effluent load is now about 40 percent what it used to be before CP practices were in place[106]. This substantial reduction in effluent load in turn permitted a smaller effluent treatment plant, which eventually could be built on the existing premises. The smaller effluent treatment plant was also less demanding on capital outlay.

[106] The *environmental* load after precipitation of metals in the newly constructed effluent treatment plant is off-course even lower.

What, then, has the *price paid* been for this significant improvement in environmental performance? Direct monetary costs have generally been modest, bar the effluent plant, both in terms of initial down payments (investment cost) and the running (operating) costs. The major price paid appears to be of a less tangible nature.

First, we can identify a 'cost' resulting from *less flexibility* and *increased complexity* of the production process. Instead of only one pickling tank, there are now several in dedicated service: one tank only pickling iron items, another tank only copper items, etc. Spent pickling baths are no longer just disposed of when the need arises. Disposal must now be planned and co-ordinated in advance with the third party production facility that takes the spent baths contents, safe transportation must be arranged etc. Rinse procedures have been modified, additional rinse steps introduced, etc. that require more work on the part of the operator. Mr. Danks openly wonders if the new procedures and practices are adhered to in full when he is not present, for instance during night shifts. Of importance to the discussion in the next sections, we can identify a possible *deterioration of productivity*[107] as an undesired side benefit from the CP practices.

Second, we can identify that the introduction of many of the CP practices has been *demanding on managerial time*. Those changes that have been of a more or less standardised nature, for instance cascade rinse arrangements, may have been less demanding because the solution has been known, only the implementation had to be arranged. This is not so for many of the low-cost innovative practices. The idea concerning the slow hoist at the chrome plating line, for instance, is specific to that production facility and can only have been devised after a fair amount of creative thinking. The waste exchange schemes are also likely to have consumed much time, primarily in identifying the exchange partner, but also in making the practical arrangements for each shipment. The cost of managerial time is unlikely to have been included in any cost-benefit feasibility estimate. The issue of demands on managerial attention will be taken up again in a later section.

[107] Note that this claimed deterioration depends on how productivity is defined. If in its standard definition as business revenue per employee, or number of bolts plated per employee hour, it may have deteriorated. If defined more broadly as 'value added' or 'profit' per employee hour, which also takes the savings into account, productivity may not have deteriorated.

Waste minimisation achievements of Club members

By May 2000, some two years after the Club was formed, about half of the Club members were actively implementing waste minimisation programmes in their factories, resulting in varying degrees of financial savings (Table 20) and reduced environmental impact.

The reported total savings achieved by the club members was in excess of R1.9 million per year due to savings in water, energy, chemical and metal use; and effluent treatment costs. For several companies the yearly monetary savings per employee computes to several thousands of Rands (Table 20, last column). To provide perspective to this figure, a skilled worker in a unionised workplace will earn roughly R 3,000 per month, or less. A handful of companies are saving one month's payroll per year, or more -- these savings are significant.

The waste minimisation programmes have also resulted in a reduced environmental impact. Less effluent water is being generated and the consumption of chemicals, oil, and other raw materials has fallen. The water consumption, for instance, has been reduced by over 64,000 m^3 per year. Barclay and Buckley (2000) therefore conclude that the club concept has thus been successful in promoting waste minimisation.

Table 20 Self-reported savings by Waste Minimisation Club members (after 2 years)

Company	*Size index*	*Ownership index*	*Preventive efforts index*	*Participation in Club index*	*Savings pr year pr employee (R)*
1	1	1	3	3	20,350
2	5	3	3	3	5,779
3	3	2	4	3	3,903
4	3	2	3	3	2,735
5	3	1	2	2	2,640
6	1	1	2	2	1,256
7	2	3	1	2	1,100
8	4	1	2	3	469
9	5	3	3	2	121
10	3	3	1	1	114
11	5	3	2	3	110
12	1	1	2	3	96
13	1	1	1	2	37
14	5	3	1	2	26
15	5	3	3	1	-
16	2	3	2	1	-
17	2	1	1	2	-
18	1	1	1	2	-
19	1	1	1	1	-
20	5	3	-	1	-
21	2	1	-	1	-
22	4	2	-	-	-
23	4	1	-	2	-
24	2	-	-	-	-
25	3	-	-	-	-
26	2	1	-	-	-
27	5	1	-	-	-

Legend

"-" (dash)= zero, not reported, or unknown

Size index
1: 1-10 employees
2: 11-25
3: 26-50
4: 51-100
5: 100+

Ownership index
1=single owner
2=two owners,
3: prof. mgmt

Preventive efforts index (1=simple, 4=extensive)
1: mainly better housekeeping, e.g. fixing leaks
2: process changes, e.g. cascade rinse
3: technology changes, e.g. eliminate cyanide
4: product impact, e.g. substitute Cd with Zn

Participation in Club index (0=none, 3=high)
0: little or no attendance
1: attends regularly
2: reports back on savings achieved
3: shares information and experiences

Source: Susan Barclay, University of Natal (Durban), email dated Jul 4, 2000.
I am grateful to Ms. Barclay for helpful discussion in setting up and scoring the indexes

About 25 percent of the Club members account for about 95 percent of the total financial savings. The companies with the higher saving have generally made more extensive preventive cleaner production efforts. A small number of companies have obviously benefited much more from the Club than other members have done. It has sometimes been difficult to call the attention of companies and Barclay and Buckley (2000) speculate in the quote below if the Club concept bears on a too simplistic set of assumptions to motivate companies:

> "It was clear that in order for waste minimisation to become a priority in an industrial organisation, both the carrot and the stick approach needs to be used. The stick, in terms of effluent requirements and charges, and the carrot, the financial and environmental benefits. Especially in South Africa, where resources are so inexpensive, it is felt that *there needs to be a stronger motivating factor to implement changes than only the financial benefits to the companies*. (Barclay and Buckley 2000, emphasis added)

Besides the highly visible monetary savings and the reduction in water consumption there are a range of benefits, which are less tangible, but unlikely are less important. First, while some Club members are not visibly making changes on site, they are at least more aware of the pollution caused by their processes and have access to information on methods to reduce their waste. They may also be motivated to do more when they realise the savings achieved by the more active Club members.

Second, the Club has established a means of communication with the electroplating industry. The Club members used this newly established channel of communication to negotiate a relaxation of the original stiff effluent water requirements. But the authorities also benefited from this communication and the emerging sense of trust. A plater told me, for instance, that he had informed the authorities about simple tricks and cheats commonly used by the industry to deceive the pollution inspector and defeat effective environmental inspections. In an interview, representatives from the environmental authorities did not appear to recall that, but acknowledged that their understanding of the metal finishing industry had improved, both technically and as a social group[108].

[108] Some Club members expressed disrespect for the technical proficiency of the pollution inspectors, claiming they "can't tell the difference between a bath tub and a rinse bath". Ironically, these views were somewhat mirrored by the enforcing authorities, who felt that some of the platers only had a superficial technical knowledge about plating operations. I was unable to ascertain how widespread either views were. In interviews, both platers and regulators said that they used to hold enemy pictures of each other but that communication through the Club improved the relations. The first meeting between Club representatives and authorities was described to me as resembling "an angry divorce procedure". Later, key individuals went scuba diving together in their leisure time; indicative of a new sense of trust. Again, I was unable to ascertain how widespread and

Third, key Club members eventually formed a Metal Finishing Association for the KwaZulu Natal region[109]. There was some discussion if members of the association should adhere to some minimum environmental standards, i.e. signs that mutual regulation was emerging, in which the industry, in an act of self-interest, disciplines itself.

The metal finishing industrial sector is notorious for being fragmented and disorganised, sometimes anarchistic, with backyard and moonlighting 'cowboy' operators. Mutual regulation holds significant potential because the disorganisation of this industrial sector makes traditional command-and-control regulation and enforcement difficult. There are large potential conflicts of interest within the industry, which may serve to strengthen processes of mutual regulation. An industrialist who has invested in an effluent treatment plant and struggles with the sludge that it generates is unlikely to show any tolerance and solidarity with competitors that do not meet costly environmental requirements and therefore are able to undercut prices. A small plater who meets environmental requirements will be outraged by unfair price competition from cowboy operators. The industry monitors competition fervently and is the first to know about rule-breakers. It is essential that authorities tap into this source of information and mutual regulation may provide just that.

These developments took place when I was leaving South Africa and I do not know the later developments. In my view, the formation of the metal finishing association may be the most important outcome of the developments in Durban.

deep-seated this was. Another active Club member, for instance, maintained a clear us-and-them attitude towards the authorities and dismissed notions of trust. What remains, though, is that the Club improved relations between key individuals representing the authorities and the electroplating industry, and that this relationship improved the authorities' ability to undertake effective inspections. The ability to undertake more effective inspections is a side benefit of a broader nature, that reaches out also to non-members of the Club.

[109] By mid-2000, the Danced cleaner production project for the metal finishing industry was about to be launched. Some Club members, notably Mr Danks, worried if the Danced project's limited investment subsidies would ever reach the industry in Durban. It was felt that the hot-dip galvanisers in Johannesburg were in a far better position to enter agreements with Danced because of their better organised structure. In response to these concerns, a Metal Finishing Association was formed in the KwaZulu Natal region, which will promote waste minimisation as one of its core activities. The newly formed association would enable the Durban industry to approach Danced in a unified manner, hopefully becoming a more attractive cleaner production partner. In the perspective of project planning and control, it is ironic that this major, yet completely unforeseen, development took place before the (delayed) Danced project even is started. This Danced project is covered in more detail in a previous section.

The WISE concept -- an opportunity for integration?

The hypothesis

The metal finishing Waste Minimisation Club in Durban had aroused a good deal of interest within South African environmental circles by mid 1999. The Club concept was presented at a conference in Cape Town in 1999. Mr. Danks presented the idea at the Danced metal finisher LFA workshop in Pretoria in 1999. And there were several other calls for Mr. Danks as a public speaker where he would present the views of an environmentally responsible industrialist and tell about the WMC arrangement and the benefits that he had experienced.

With the club concept apparently gaining increasing momentum, an opportunity emerged for integrating OHS issues into the WMC concept. The working hypothesis was that in integrated approach in the Club, dealing with adverse conditions within both the OHS and the environmental domain, would strengthen the overall process. Earlier research (Rasmussen 1995:245) had indicated that in particular the small enterprises did not maintain a clear distinction between environmental issues and working environment issues. A unified approach to root problems which have detrimental effects within both domains could benefit the entire process, very much the sort of arguments for integration laid out on page 40.

The WISE concept

By chance, Mr. Limborg of CASA, a Danish consultancy, alerted me to an OHS intervention program developed by the International Labour Organisation (ILO). The so-called Program for the Improvement of Working Conditions and Environment, known as PIACT after its French name, was first launched in 1976, more than two decades ago. During the 1980s, elements of the PIACT program had been refined into a ready-to-use ILO training package specifically targeted at small enterprises in developing countries (Kogi 1990:242). This training program eventually became known as the Work Improvement in Small Enterprises (WISE) concept. The program comes as a package comprising a Trainer's manual, an action manual, and checklists (Thurman et al. 1988, 1994) and was easily available from the ILO Pretoria office.

The WISE concept is in many respects both conventional and pragmatic, yet innovative. The conventionality stems from the concept's key assertion that better working conditions lead to higher productivity. This argument reflects a long-established strategy to persuade business owners that they should pay more attention to OHS issues. The clear documentation and emphasis on positive links between preventive OHS and financial cost-efficiency was a major strategy already at the times of the US Safety First Movement in the early 1900s (see page 172). The elements of the WISE concept are

also traditional and time-tested, for instance comprising: materials storage and handling, work-station design, and machine safety (Figure 42.)

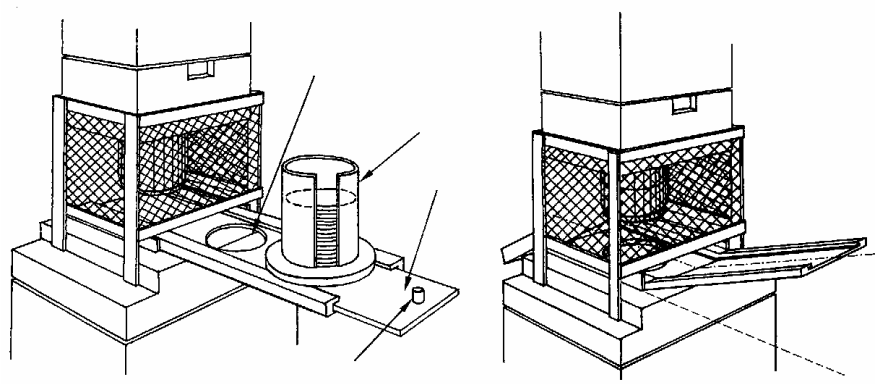


Figure 42 Guarded power press with simple feeding and ejection devices

The use of feeding and kick-out devices may increase productivity dramatically while at the same time greatly reduce machine hazards. Figure shows a power press with plunger and magazine feed (left) and one with inclined chute feed (right). The two examples are provided in the WISE action manual.
This approach to accident prevention has unmistakable roots in the Safety First Movement of the early 1900s. See the discussion of August Kaems 1919 contribution to power press safety (page 172).

Source: Thurman et al. (1994:45)

While these areas of intervention may not be new, not breaking any new ground, evidence indicates that they are still extremely relevant to address[110].

The WISE concept focuses on simple, efficient and low cost methods to improve working conditions, reflecting a highly pragmatic approach to OHS improvements. The objective is to improve the existing situation, of making changes to the better; not necessarily to attain some distant ideal situation in which all standards are adhered to. Or quoting from the first page of the trainer's manual:

> "Throughout [this training event], the emphasis is placed on starting a process of improvement rather than on the specific improvements

[110] In Australia, there is a high incidence of injuries due to mechanical equipment and the injuries are generally quite severe. Mechanical equipment injuries account for a major proportion of traumatic injuries in Australian industry, representing 28 percent of all compensation injuries. It was found that machinery in small Australian manufacturing firms was generally old, damaged and not well maintained. Most of the machines assessed had poor or non-existent safety features particularly relating to guarding and emergency stops. Lack of safety features was related to the age of the machinery: older equipment was often manufactured without safety features, and as machines become older, guards were more likely to be lost or damaged (Gardner et al. 1999).

> that are to be made. This is because initiating an improvement process is especially difficult in small and medium sized enterprises. The success of efforts to improve working conditions will often depend more on the costs and benefits for the employer than on the severity of the problems themselves. It should be clearly understood that nothing in this approach is intended as a substitute for legal standards, the work of inspectorates ... Instead it is hoped that the approach can complement other efforts towards the improvement of working conditions" (Thurman et al. 1988:1).

The WISE approach is candidly pragmatic.

The problem - addressing owners-managers of small companies is a complex and difficult affair

While the elements of the WISE concept are conventional, the implementation strategy is innovative. It builds on action oriented learning and emphasises participatory methods and group discussion. Above all, it is built on the spread of positive ideas and practices from one enterprise to another, rather than on criticism. Owner-managers of small enterprises that are interested in participating in the WISE program are envisaged to organise in a *group* in which participants will exchange ideas and experiences and programmed training activities undertaken. Group participants are encouraged to visit each other's enterprises and bring forward suggestions. While the term *'Club'* is absent from the WISE manuals, this is effectively what is going on.

The Trainer's manual (Thurman et al. 1988) observes that the training of owners-managers of small companies is a complex and difficult affair. Correctly identifying and recognising the special needs and characteristics of this group of people is crucial for a successful outcome of the intervention. This entails recognition of key constraints as well as opportunities, and adapting to them.

Key *constraints* are that, generally, owners-managers of small companies will not look actively to outside help, particularly professional help, in formulating improvements. This is especially true for working conditions. They may be hostile or at best lukewarm towards approaches from training or assistance institutions, consultants and professionals. Even those entrepreneurs who have an interest in learning may have prejudices against formal training: they are unlikely to be interested in education and training for its own sake. The owner's main concern will usually be to maintain the business and solve routine problems. They will have limited time and resources for activities, which are not linked with short-term profit. The owner considers that he *is* the business, and may therefore take any criticism as a personal slight.

Key *opportunities* are that the owner-manager is the prime decision-maker in the business, indeed maybe the sole decision-maker, who is

in a position to make and implement decisions swiftly. They are likely to have more respect for advice from other independent owner-managers than from external specialist or formal training programmes. While they often are autocratic towards their workforce they usually have a paternalistic interest in helping them and may even feel personally responsible for their well being. They are likely to be closer to the shop floor and their workforce than the manager of a large company; they are therefore more likely to understand technical problems and to be capable of taking informal, flexible approaches to solving them. Also, praise of the business is likely to accepted very warmly as personal praise of the owner.

The solution -- action oriented training principles

Recognition of these issues has lead the WISE training approach to hinge on group (Club) activities. This is especially true with regard to the independent owner-manager's perceived mistrust towards the normal conveyors of professional assistance: experts and authorities. The WISE concept presumes that an independent owner-manager of a small enterprise will only genuinely respect the advice of *other* owner-managers of small enterprises. Therefore, the group (Club) is essential as a vehicle for owner-managers to train other owner-managers. This analysis leads the WISE approach to be based on the following core training principles:

- *Build on local practice*. Change is best stimulated by starting from the real problems of the company instead of the priorities of outsiders. Approaches designed should be flexible and informal, and carefully geared to the company's capability for action. Generally this means emphasising simple improvements which are already in use in some local companies

- *Focus on achievements*: It is necessary to identify praiseworthy achievements and to avoid criticism. This improves communications with owners-managers and helps to get them involved

- *Link working conditions with other management goals*. The identification of low cost solutions to problems of working conditions is not usually a sufficient inducement to change. Managers need to understand that solutions to their everyday production-related problems are tied to improvements in working conditions

- *Use learning-by-doing*. Al learning should be linked with action directed at solving problems. This means concentrating on areas where immediate action can be taken. It also means using the managers' existing knowledge and promoting self-reliance.

- *Encourage exchange of experience*. Local self-reliance and enthusiasm are encouraged by opportunities for discussion with

other business managers and visits to other small business premises. It is necessary to build support groups of small business managers and to provide incentive for these groups to continue to work together. This helps to reinforce action and to increase the feeling that the content of the training programme belongs to the group.

While the WISE concept is purposely developed for use in developing countries it is probably more correct to characterise it as targeted specifically towards owners-managers of *small* enterprises, irrespectively of whether those small enterprises are located in developing or industrialised countries. Mr. Limborg, for instance, had used the WISE training concept in a small company setting in Denmark, with success (Limborg and Hasle 1996).

The opportunity for integration

An analysis of similarities and difference between the WMC and the WISE concept is favourable to integration. The concepts share the following similarities:

- Both concepts identify the firms' owner-manager at the focal point for the intervention.
- Both concepts rely on a Club (or group) setting, in which the activities take place.
- Both concepts rely on the provision of expert knowledge in combination with more informal activities and social interaction in which sharing of information and experiences takes place
- Both concepts rely heavily on improved cost-efficiency as a major driver to influence the decision making behaviour of companies.

With so many similarities and no obvious differences, there would appear to be an clear opportunity for a successful integration at the level of methodology.

Enter WISE into the Durban WMC

Preparation and intervention method

The empirical work took place in the period September 1999 – June 2000. I first contacted Prof. Buckley, who is formally responsible for the metal finishing WMC pilot club study to the Water Research Commission, and Ms. Barclay, who organised and ran the activities of the WMC. Both are with the University of Natal, Durban. They were positive to the idea of bringing OHS issues into the Club setting, conditional, however, that the Club participants were interested. They therefore suggested that I contacted some of the business owners to

hear their reaction. Acting on Ms. Buckley's advice, I visited six participating businesses, which were felt to be major informal opinion formers of the Club. If I could secure their support of the idea, the rest of the Club members would likely back the idea as well, she felt.

Having visited the six participants and outlined my ideas, I then made a more formal presentation at a Club meeting on Oct 19, 1999. At this point in time the Club had existed for over one year. In my presentation I outlined how integration may limit sub-optimisation and I briefly presented the WISE concept, emphasising the concept's link between productivity improvements and OHS improvements. The owner-managers that I had visited prior to the meeting then expressed support of my proposal, after which all Club members, as expected, agreed to it.

The training program, outlined in the WISE guidelines, naturally presumes that the WISE activity is the main activity that takes place. This is not the case in the WMC setting, in which the threat of strict environmental regulation was the main concern of the participants. Consequently the WISE training programme had to be modified quite extensively, however still being true to the core training principles, which are to build on local good practices, emphasising positive achievements, avoiding criticism, and seeking to link OHS prevention with other management objectives.

In practice, this meant that I would visit participating enterprises on the lookout for simple and effective practical solutions already in place to, what I believed, were common problems to the enterprises. My search for solutions and problems was guided by the examples provided in the WISE action manual. Whenever I found good local practice, I would seek to document it by taking a photograph. The idea was that the presentations at the Club meetings should be based, as far as possible, on local good practice, reinforcing and spreading positive achievements. A substantial part of the training material therefore had to be developed specifically for that Club setting, only little of it could be of a more general nature. Presentations at the Club meeting would therefore comprise slides demonstrating a good solution to a common problem, that one Club member had already implemented. I was careful to be open about all camera work and securing explicit permission from the business owner prior to displaying any information on a Club meeting.

Over the entire period September 1999 – June 2000, fourteen factory visits were undertaken and many unstructured interviews conducted. Two presentations were given at Club meeting. On two occasions was a presentation first given on the premises of a business, seeking to involve a broader audience than the single representative that attended the Club meetings.

The two presentations given

The first presentation was given at the following Club meeting, which was on Feb 23, 2000. The presentation comprised a combination of two of the training manual's headlines, control of hazardous substances and effective ventilation of premises. The reasoning for combining these two subjects was that excessive heat was a common complaint at the business premises that I had visited. Many of the production processes gave off waste heat and the visits had taken place in January and February where the summer temperatures in South Africa peak. While the ventilation topic was highly relevant to the Club participants, it was not immediate appropriate in a cleaner production context, as it would often link more to mitigation, than to prevention at the source. I therefore decided to link the ventilation topic with the control of hazardous substances topic. The latter is relevant not only for ventilation, but also as a good vehicle to illustrate the principles of prevention at the source. Hazardous substances are furthermore often fine examples of twin problems, causing problems both in the OHS domain and in the external environment.

The fist part of the presentation focussed on various means of low-cost chemical hazard control, emphasising substitution to a less dangerous substance, and reducing source strength by means of covers and lids. I tried to use every opportunity to emphasise how the various means applied the CP principle of prevention at the source. The second part focussed on simple means to improve ventilation. Topics covered included: normal air flows in a room, not confusing recirculation for ventilation, simple applications of push-pull ventilation, means of protecting the factory from outside heat and cold, and letting natural air-flow improve ventilation.

I gave this presentation twice in a company setting. Approaching the companies directly was an effort to involve the employees on a broader scale, and not only the company owner-manager. The presentation covered a relevant nuisance topic, the high indoor temperatures, as well as the core CP principles of prevention -- issues which I felt would be relevant also to lower ranking employees.

The second presentation was given at the next Club meeting, on May 15, 2000. It comprised three parts. The first part was a follow up on the principles of hazardous materials control and ventilation, presenting additional practical examples of local good solutions which I had come across on visits to other participants sites since the last meeting. The second part covered productive machine safety because several Club participants had a production of metal items, using power presses, punches, grinders and other types of machinery, which may constitute a hazard to workers. Emphasis was given to eliminating the hazards by installing automatic feeding and ejection devices, or alternatively by guarding the moving machine parts. The third part covered various techniques to improve materials storage and handling, emphasising better organised storage, the value of well laid-out and

tidy workplaces, and various types of racks, containers, bins, cabinets and trolleys.

Over the period September 1999 – June 2000 fourteen factory visits were undertaken and numerous unstructured interviews conducted. Some factories were visited more than once. It is clear that there are multiple and complex interactions between the researcher (me) and the business owners, who's behaviour is the subject of my attention, and which I actively seek to modify. The interaction is very much of a person-to-person type, which is difficult to standardise, and sometimes difficult for oneself to be completely cognisant of. This research activity thereby clearly positions itself in the action research tradition, actively attempting to bring about change, and where hypotheses are generated and tested on a continuing basis. In this process, the researcher actively interferes with the subject of the research thereby departing from standard positivist quality criteria to research. The major quality criteria within this research tradition is not objectivity, but whether change has been brought about or not.

Discussion

The Club members did express interest in OHS issues. When undertaking factory visits, I felt that they were genuinely interested in hearing what I had to say, both concerning productivity improvements and OHS issues. There was also a general consensus that good working conditions were an important element in having good industrial relations with the workforce. I also felt that the presentations were well received, the participants were genuinely interested in the problems and the practical solutions that were presented. In particular the second presentation had a good audience response, when the principles of preventive effort within the OHS domain were emphasised, pointing out similarities to prevention achieved through waste minimisation.

However, the WISE concept is action oriented and *should as such be evaluated against the actions and changes the intervention produced*. An assessment of this type is not favourable to the successfulness of the intervention. Within the limited time that I was following the Club, very little change took place. At an evening meeting, one of the Club members enthusiastically told me how he had improved the ventilation at his premises. After he had heard my presentation on gross airflow patterns, the push-pull principle, and how to enhance natural ventilation, he had simply taken part of an internal wall down in the production hall. I am not aware of other changes that have been initiated as a result of the presentations given. In a narrow sense, the intervention was therefore not a success.

There may be several reasons for this, which are discussed in the sections below. First, some reasons arising out of the practicalities of the intervention will be discussed. Second, I will discuss a failed attempt to introduce new actors onto the scene, notably the employees.

Third, I will discuss whether some fundamental assumptions of the WISE concept are flawed.

The practical setting less than ideal for WISE

Three practical issues concerning the WISE intervention can be identified, which were less than ideal. First, and most obvious, that it was only possible to give two presentations over the course of the 8-9 months of my involvement. Much time was consumed from making initial visits, securing the necessary approval from Club participants, and preparing training material. It can thus be questioned if this intervention at all reached critical mass. At the extreme, it may be argued that the WISE concept has not been genuinely implemented, that only a discount version has.

Second, it may also have played a role that the WISE presentations were a latecomer activity, which took place when the initial enthusiasm of the Club members had begun to level off. Perhaps members would have been more motivated for WISE if the activities had taken place right from the start.

Third, it is possible that OHS issues simply have not been a priority to the Club members. Both the WMC and the WISE concepts assume that some initial screening and selection procedures of companies take place to ensure that only genuinely motivated companies participate. This important screening activity has obviously not taken place with regard to WISE, only with regard to WMC, possibly jeopardising the intervention.

Observations from the company visits -- frustrations, economic worries, and uneasy industrial relations

Many club participants expressed frustrations over the massive changes that were facing their companies. The threat of tightened effluent standards was taken seriously, as it was felt to have the potential to threaten the survival of the firm. Consequently, most companies were reviewing plans for effluent treatment plants, and some were in the process of installing equipment (primarily large holding tanks).

Some companies were moving away from the traditional cyanide zinc process to a new cyanide-free alkaline zinc process. In one of the larger companies (Company A) this change gave rise to massive quality problems with rejection percentages going as high as 20 percent (Figure 43). Eventually these problems led Company A to outsource some of the plating operations to 'jobbing' companies (of which some were continuing with the cyanide process), at increased costs. Company A was unwilling to return to the traditional cyanide process. When using a cyanide-free process, they could declassify the toxicity rating of their sludge, and dispose it off as industrial waste.

This solved an acute waste disposal problem, which was created by the closure of Durban's hazardous waste landfill site.

Besides frustrations with new more environmentally friendly process technology, many Club participants also expressed worries over the troubled economy and a bleak economic situation of the company: That they increasingly had to compete with imported goods from the Far East that were both cheap and of good quality. That the demand for their products was slumping, and that high interest rates made most investment projects unfeasible. In the larger companies, white personnel in middle-management positions were also concerned about trends to downsize and worried about the prospects of affirmative action policies, which would likely endanger their employment security.

Figure 43 The change to a cyanide-free zinc plating process created severe quality problems.

The picture shows the supervisor of the plating operations (left) and an operator inspecting the quality of freshly plated product coming from the cyanide-free zinc barrel plating process line. The company experienced rejection percentages of up to 10-20 percent, eventually forcing the company to outsource some of its plating work.

Add to these frustrations and worries a dose of troubled labour relations and conflicts about distributive issues. Wages are still divided along mostly racial lines. Almost all the companies that I spoke to claimed to have fine, although perhaps slightly complicated, labour relations. However, I was sometime unsure about what the company owners meant, when they referred to 'fine' labour relations. To some, I suspect, it meant that there was no immediate threat of strikes.

In a medium-sized company, I was given an intriguing and detailed account of clandestine subcultures of organised workers that bore remnants of what I had read about apartheid's shop floor ungovernability phenomenon. Management would suddenly notice that something is wrong on the shop floor. Suddenly, without apparent reason, nobody wants to do overtime, seriously disrupting production schedules. Management suspect that it is the result of a power play between rival shop floor factions, but have no clear idea of who they are. Scared employees call management representatives in the evenings telling tales of intimidation and fears of violence if they do not support the unofficial 'work-to-rule' (that is: work slowly) decree. Management believe that the claims of intimidation and fears of reprisals are credible and authentic because workers, probably scabs, from a neighbouring company were once shot dead on the road just outside their fence. I have not sought for independent verification of these stories. But regardless of whether they are real or imaginary, they are indicative of troubled and mistrustful labour relations.

Communication between management and workers appears to be troubled by language barriers and it is not uncommon for communication to take place through middlemen. For instance, one owner-manager of a company with 50-100 employees, told me that about half of his staff did not understand English, except very simple phrases such as "put it down" and "fetch that". He did not speak Zulu himself. He recalled a situation where poor communication led to problems. At that time, he kept an attendance bonus system to motivate employees to show up on time. Sometimes he had to talk to the shopsteward (the middleman) -- "Listen, if those latecomers don't improve, you will lose the bonus. I don't know what he tells the guys out there, but then suddenly some of them show up at the office, extremely cross. Why do you want to fire us? Then I must explain to them that I just want them to show up on time."[111]

In summary, the business owner-managers face a turbulent and kaleidoscopic reality. Frustrations over new legislation, worries about the economic situation and the survival of the firm, severe production disruptions due to the introduction of new technology, uneasy and mistrustful labour relations, communication problems with the workforce, the list goes on. Each of these issues compete for the attention for the owner-manager. But not all claims for attention can be honoured.

For OHS issues, environmental issues, and, indeed, any type of issue, this means that they may be bumped down in priority, if other acute threats appear. Owners-managers may find OHS improvements morally appealing and perhaps also rationally attractive from cost-benefit considerations. They may even show upbeat interest in OHS issues. However, if they face other bigger problems or if they perceive

[111] Quoted from memory and notes taken immediately after meeting. Interviews and conversations were generally not recorded.

it as a nice-to-have, and not a must-have, little action may take place in practice.

Involving lower-level employees of the companies

As noted earlier, the presentation on control of hazardous substances and ventilation was given twice in a company setting, trying specifically to involve lower ranking employees. My initial requests for involving employees were politely turned down. When I kept pushing in one company, the manager (politely) closed the issue with "... you must understand, that although we now officially have democracy in this country, this is not the case in industry".

The presentations were therefore given to the supervisor level. At the first company the presentation was well received and we had a good discussion when walking around at the premises, looking for the types of issues that had just been presented. I had a clear feeling that the presentation had inspired the participants and provided them with new knowledge. They now looked at their premises with fresh eyes. However, it is unclear if the WISE presentation spurred any immediate improvements or if the supervisors were quickly absorbed by pressing routine tasks when returning to their regular duties.

At the second company, the presentation was less well received. It was my impression that one of the supervisors was nervous, intimidated by the simultaneous presence of the owner-manager and me, perhaps fearing to loose face. As a result, he was more interested in defending the present state of affairs than in bringing up suggestions for improvements.

In summary, the attempt to involve shop floor personnel in the WISE concept was a failure. The attempt to involve the supervisor level was a partial success. If, however, evaluated from the ability to bring about change, this attempt was unsuccessful, at least in the short run.

Information sharing amongst firms -- a naïve assumption?

Both the WMC and the WISE concepts assume that owner-managers are willing to meet on a regular basis and exchange ideas and experiences on how to prevent pollution, save money, or improve productivity. At the CP workshop in Pretoria (page 148) an owner-manager of a Johannesburg electroplating business questioned precisely this assumption. He asked, why he, who had struggled for so many years to learn the tips and tricks of the trade, should give away this information to his competitors? This basic contention is that fierce commercial competition and selfish business behaviour are simply incompatible with (naïve) information sharing arrangements.

Indeed, there was some evidence in support of this view. For instance in the case of Company A, that experienced serious quality problems when switching over to the cyanide-free zinc process. Eventually

these problems led Company A to outsource some of the plating operations to jobbing companies. I was told that Club members had entered a gentleman's agreement. When outsourcing took place, jobbing shops of other Club members should have preference over non-Club members. In particular Company B, a medium-sized jobbing shop, appeared to benefit financially from this arrangement.

This outsourcing arrangement, however, gave rise to *obvious conflicts of interest*, which impeded the exchange of experiences in the Club. On at least two occasions, I felt a marked unwillingness of a jobbing shop owner-manager to share too much information about how to properly control the process parameters of the cyanide-free process. Knowledge about CP plating technology had suddenly become a competitive parameter.

There was, however, also evidence of the opposite situation, that companies did exchange ideas and information in the Club.
I overheard a Club meeting where Club members discussed how to construct floors properly. Floors in plating shops take a heavy toll from spills of acids and other aggressive chemicals and the platers discussed their experiences with concrete floors, epoxy coatings, asphalt membranes etc. They also discussed the pros and cons of turning off their rectifies over weekends to save electricity consumption. One company informed that an employee operating the trichloroethylene degreaser had tested positive for excessive occupational exposure to that chemical and that they were considering various options, including finding alternative degreasers. Owner-managers also exchanged sketches of effluent treatment plant designs.

Some Club members were not enthusiastic about having other Club member visit their factory. In-line shops, that perform metal finishing operations on items that they manufacture themselves, were generally positive to company visits. But jobbing shops were not. It appears that this was not so much to guard sensitive or effective technology but because of fears that competing jobbing shop could figure who their customers were. Visits amongst Club members were thus partly hampered, not by production secrets, but by shielding sensitive customer information.

In summary, there was no empirical evidence of altruistic behaviour. Only some members contributed and only certain types of information were disclosed. Yet, the overall conclusion is that information exchange did take place. There appears to be much valuable advice that can be shared, which do not have an effect on the competitive situation.

Productivity -- a driver for OHS improvements?

It is a key assumption of the WISE concept that productivity is a major motivating factor when approaching companies. Productivity is also assumed to have a certain appeal to most business owners. Productivity is assumed to make most business owners listen to what you have to say. The WISE concept candidly uses productivity improvements to leverage OHS improvements.

However, at the factory visits, I was increasingly puzzled if productivity, in practice, was an issue of major importance to the companies. For instance, one of the Club members was the owner-manager of a medium sized company with 50-100 employees (Company C). The company was manufacturing ornamental items, primarily using two zinc die casting processes. The zinc items are polished in a 'grinder' in order to remove imperfections (fins) from the casting process before they can be coated or electroplated. The grinder vibrates the zinc items with small polyester balls in a water/detergent slurry -- a process which produces substantial amounts of waste waster contaminated with fine zinc and polyester particles. On the environmental authorities' request, a filter press had been installed to take out the solids before discharging the wastewater to sewer. The company owner-manager had also modified the piping, in order to recycle the filtrate water back to the grinder. This modification reduced the water consumption considerably and took place while the owner-manager participated in the WMC.

However, the zinc/polyester filter cake still had to be disposed of. With the Durban hazardous waste landfill site closed, drums containing filter cake were accumulating on the premises -- an obviously unsustainable situation. This unresolved waste disposal issue was the main concern of the owner-manager in Club discussions.

I paid Company C a visit while searching for good local practice for my Club presentations. The company owner-manager and his son took me around on the premises. It was my clear impression that the owner manager was genuinely interested in hearing what type of advice I could give.

I made four major observations: 1) little attention was paid to OHS, 2) there were several examples of inefficient operations,
3) in those examples would productivity improvements through better design also improve the OHS situation, and 4) productivity did not appear to be a priority issue to the owner-manager. They are detailed below.

Figure 44 Noisy power presses located in the middle of a large production hall

Nearby workers doing silent fine assembly work are exposed to high levels of noise when the power presses are running, which they do about three days a week. A major OHS problem could have been eliminated when this layout was planned at little or no additional cost, simply locating the power presses where the noise can be confined. Once located however, a resolution of the noise problem becomes expensive. In another large company I observed an identical situation with two continuously operating power presses located in a production hall where otherwise mostly silent work operations took place.
It appears that, in general, little attention is paid to OHS issues when production layout is planned.

ad 1) The layout of the production facility had been planned with minimal attention paid to OHS issues. For instance, three noisy power presses were placed in the middle of the largest production hall, most likely from product flow considerations (Figure 44). However, with this layout, a considerable fraction of the workers in the production hall suffered from high levels of noise. I also observed a similar layout pattern in other companies, supporting my hypothesis that OHS considerations are largely absent when the layout of (new) production equipment is determined.

ad 2 and 3) Several cases could be identified, in which work operations were not organised and executed efficiently. In one example, a female worker was operating a plastic injection moulding machines. The pressing tools were either not aligned properly or were defective; causing the automatic ejection mechanism to jam.

Figure 45 Operator intervenes frequently in order to release jammed item in injection moulding machine

The frequent stops caused the injection moulding machine to operate below maximum production capacity. At the time of my visit, this appeared to be of minor concern to company management representatives. A resolution of this situation will improve both productivity and OHS conditions (hot surfaces, work posture)

The operator then had to open the protective hood and reach in near the hot pressing tools, manually release the jammed plastic item, and restart the machine cycle (Figure 45). The operator had to intervene once a minute or more; an obviously inefficient operation as the many stops caused the moulding machine to operate far below its maximum production capacity. It also involved OHS dangers, reaching in near hot surfaces, bad work postures, and others.

The WISE manual repeatedly emphasises the value of the positive example; the need to identify praiseworthy achievements and to avoid criticism. This is particularly true for owners-managers of small and medium sized enterprises, who may easily perceive any critique of their business as a personal critique. The manual therefore states that there shall be no mention of problems during the visits, *unless* the owner-manager raises them. The visit shall concentrate on picking up the achievements of the company, even if some seem to have little to do with working conditions[112].

[112] The Trainer's manual also states that during the visits any notion of 'inspecting' or 'auditing' the company must be avoided (Thurman et al. 1988:14-15).

Figure 46 Productivity can be improved with better design of the work stations.

Productivity did not appear to be hampered by lack of machinery. But the work station design had clearly received less than its fair share of investment resources. A minor investment would improve productivity dramatically. This would also improve OHS conditions (work posture, lighting).

Occasionally, I found it difficult to adhere strictly to these guidelines. In this case, I mentioned to the owner-manager's son (the owner-manager had just left to answer a phone call) that the frequent jams caused the moulding machine to operate well below full capacity. He told me that the pressing tool probably was worn, and I was left with the impression that this was an issue of minor concern to management.

There were other examples of inefficient planning and execution of work operations. Figure 46 shows the spin die casting operations area. Moulds are produced from a silicone compound and the casting takes place by pouring molten zinc into the mould while it spins in a centrifuge. The production area appeared well equipped with machinery. The work station design in this particular production area, however, appeared to have received less than its fair share of investment resources and consideration. The arrangement of tables and chairs was not optimised, and tools and work items were not kept in bins within easy reach. It also appeared that no particular consideration had been given to inefficient work postures. In short, there appeared to be a large and quite obvious potential for productivity improvements through better work station design; a workstation redesign that would also improve the OHS situation. Some of the other work stations in that factory were more efficiently designed, indicative that lack of knowledge was not the cause.

ad 4) It was my impression, that productivity was not a priority issue to the owner-manager. When encouraged to tell about his business concerns he preferred to mention market related problems, the general

slow-down of the South African economy, the problem with cheap imports, etc. I had the impression that he was running on less than full production capacity because the market could not absorb more. The factory appeared to be overstaffed[113].

The owner-manager appeared to be highly interested in *savings*, but less so in *investments*, in which an initial cash outlay is needed in order to generate higher future cash flows. Times were difficult, the cost of investment capital high, the future uncertain, etc.

Over and again, I was presented to such claims by business owners. At face value the claims sound plausible, as they resonate well with the general gloomy mood in the business sections of major South African newspapers. Yet, I sometimes had my doubts if they were wholly genuine. Business owners may have an interest in presenting an exaggerated dismal picture of their economic state of affairs. This may serve not to raise undue expectations amongst employees, for instance concerning pay rises. If public servants believe that the company's survival may be threatened by new regulatory requirements, such demands may be delayed or relaxed, not to put community employment in jeopardy with that range of negative social consequences this will have. It is worth mentioning that none of the business owners was willing to share financial information, to 'open the books', with the employees or with the researchers from the University of Natal. As one business owner observed, while it might be tempting to open the books in a 'bad year', he would not be prepared to do so in a 'not-so-bad year'. (I sometimes wondered if the phrase 'good-year' is absent from the vocabulary of owner-managers of small firms.)

The strategy of using productivity improvements to leverage OHS improvements could thus turn out to be an uphill battle. Not only could productivity be perceived as an issue of less importance relative to other business objectives, but the scope for productivity improvements would be seriously limited if the restructuring process was starved for investment capital. As an extra possible complication, if employees perceive productivity improvements to conflict with their employment security prospects, they may contribute less than wholeheartedly or seek to spoil the efforts.

[113] The situation reminded me of the fish canning factory that participated in the Danced cleaner production project (page 124). The production manager of that site said that rationalisations were postponed and excessive staff levels were maintained for political reasons in order to obtain fish quota concessions. The point is that major business decisions, for instance regarding staffing levels, may not be informed by standard business rationale.

The key points of this section can therefore be summarised as follows: *In theory*, there are compelling arguments for linking OHS improvements with productivity improvements, as the WISE concept prescribes. *In practice* however, it appeared that productivity was not a high priority issue, at least not high enough to effectively call the attention of the owner-manager. This view on attention will be developed further in the section that follows.

These observations are quite consistent with earlier experiences reported in the literature. Much evidence exist in support of monetary savings resulting from workplace interventions that optimise work station design. For instance, Aarås (1994:1693) reports that an investment of NOK 0.34m resulted in order-of-magnitude higher savings of NOK 3.2m (NOK: Norwegian Kroner). The investments went into more efficient work station design and the savings resulted from productivity improvements and improved occupational health and safety. Yet, another author observes:

> "No sensible organization can afford to ignore for 40 years a contribution which could potentially improve both its productivity *and* its safety. Yet it appears that the vast majority have done exactly that. Given that this is the case, we are forced to conclude either that the vast majority of organizations are not sensible, or that they simply do not know what they are missing.... We must ... conclude that they simply do not know what they are missing." (Simpson 1990, quoted in James et al. 1994:954, emphasis in original).

Mystified and puzzled by this failure of industry to react to cool rational arguments, experts in ergonomics organised a conference 'Marketing Ergonomics' which was reported in the 1990 issues of the international journal *Ergonomics* -- yet, to little avail.

Still, it is important to note that my empirical observations *support* major assumptions of the WISE concept. First, productivity issues are effective when contacting business owners and make them spend time listening to what you have to say. Figuratively speaking, productivity may open the door. Second, there were many obvious instances where productivity improvements would indeed go hand in hand with improvements in OHS conditions. Third, that the process must be driven from the top, by the owner-manager or his direct representative, in order to be effective. Not only because the owner-manager has narrow control over all significant business decisions; but also simply because there is no immediately available alternative actor on the scene. Workers are traditionally only involved to a limited extent in decisions regarding their own OHS conditions. Several workplaces were unorganised, and workers generally appeared to be in a weak bargaining position due to low levels of formal education and high unemployment levels in the surrounding society.

Club performance analysed from the perspective of bounded rationality

The discussion so far has mostly taken place within the bounds of the Rational Choice paradigm. Within this framework of analysis, the decision-making behaviour of a firm (or owner-manager) is assumed to be the product of a process in which problems, alternatives, and outcomes are revealed in a systematic manner; after which decisions are assumed to be informed by cost-benefit evaluations of alternatives. The process is assumed to be linear and sequential starting with defining an inventory of problems. The Club activity (and indeed the Danced CP projects), are initiated with an environmental survey in which university students (or consultants) systematically identify and quantify emissions. Options to limit emissions are then identified and ranked according to estimated payback periods. The survey component can also be identified in the WISE concept. A group of business owners carries out informal 'audits' of each other's premises after having received a series of short lectures/presentations. The outcome of the audit is a list of improvements, loosely prioritised according to profitability. Both the Club and the WISE concepts assume that business owners act in a manner consistent with rational decision making, reviewing investment options in terms of financial and technical feasibility, implementing those where the return-of-investment exceeds a certain criterion[114].

However, decision making behaviour may also be examined in a competing analytical framework, that of bounded rationality in which *attention* is a scarce resource. The allocation of attention affects the information that is available, and thus the decision. The core ideas are that information has to be discovered through search and that the key scarce resource is attention. Theories of bounded rationality assume that there are more things to do than there is time to do them; that there are more claims on attention than can be met. If attention is rationed, decisions can no longer be predicted simply by knowing the features of alternatives and desires.

Theories of bounded attention therefore analyse and understand decisions in a framework of attention and search. *Satisficing* specifies the conditions under which search is triggered or stopped. Search is controlled by a comparison between performance and targets. If performance falls below a target, search is increased. If performance achieves its target, search is decreased. In this context, decision making is understood in a framework of search, and of limited attention.

Theories of bounded rationality offer an interesting perspective on some the Club experiences. It is noteworthy, for example, that two of the most active Club members and most successful implementers of CP practices had similar ownership structures. The Saayman Danks

[114] In principle, when the return-of-investment (ROI) is higher than the cost-of-capital. However, other decision rules are commonly applied with much higher cut-off points, for instance demanding pay-back periods of less than one year.

Electroplating business, described earlier, had two owners. It was my clear impression that Mr. Danks would have been unable to spend that much time (attention) on acquainting himself with the new principles of prevention and on innovatively putting them into practice -- for instance devising waste sharing schemes with firms that could use his wastes as raw material -- had it not been for the other partner, Mr. Ferguson, to run the more mundane day-to-day business activities. Mr. Ferguson, I believe, never took part in a Club meeting, and he quickly left the room when I discussed CP issues with Mr. Danks.

The other Club firm, Metal Protection Services, had a similar division of managerial responsibilities. The one owner, Steve Cody, was highly involved in debating the new effluent requirements with the municipality and was Primus Motor in the firm's CP restructuring efforts[115]. The other owner of Metal Protection Services took little or no part in these activities.

The successful implementation of CP practices in these two firms may thus be explained in terms of excess managerial capacity, of the availability of a surplus of managerial attention, rather than in terms of availability of information, of attractive cost-benefit ratios, or some other input to a rational decision-making process.

If a firm's behaviour is understood in terms of conflicting demands on managerial attention, which is assumed to be the key scarce resource, factors apparently unrelated to CP and OHS improvement must be included in the picture, if they make claims for managerial attention. In April-May 2000, shortly before I was leaving South Africa, the Durban municipality seemed to be in a process of re-thinking its effluent demands, perhaps relaxing on some requirements. To several companies the threat of environmental closure was perceived as being less acute. Several company owners were in the process of solving their longer-term sludge disposal problems. Some had shifted to non-cyanide electroplating processes, which permitted the sludge to be declassified in terms of toxicity and opened new low-cost sludge disposal routes. The firm with the zinc/polyester sludge problem (Company C) had found means to dispose off the sludge as regular industrial waste. A specialist waste handling company was actively investigating new ways to treat wastes, possibly converting sludge metals to their natural inert mineralogical states, thereby possibly permitting new disposal routes.

The environmental 'threat factor' and the perception of 'urgency of action' therefore lowered, and company owner-managers could direct their scarce attention to other pressing business issues. The attendance

[115] There may have been additional but unrelated reasons for the change in environmental practices in this company. Steve Cody had fallen victim to an unpleasant hijacking at gunpoint, which he cited as the prime reason why he desired to emigrate, possibly to Australia. He told me that many of the improvements in his factory were meant to make the business more sellable. He had put his life savings in that business, he said.

to Club training sessions was declining. Prof. Buckley spoke of a need to revitalise the Club. With the notable exception of Mr. Danks, many business owner-managers appeared to believe that they had 'done enough'.

This behaviour can be explained in the framework of bounded rationality and satisficing. There was, in my opinion, still an unexplored potential for CP practices and techniques in many companies, which would lower the sludge production. Some of these options would likely be cost-effective from a narrow rational economic viewpoint. However, they were not explored because the companies felt that their present solutions were 'good enough' (satisficing). The search for solutions was halted and scarce managerial attention was directed elsewhere, to other problems of higher perceived urgency.

In the perspective of bounded rationality, it is possible to identify important limitations in the implementation process, which the Waste Minimisation Club (WMC) concept shares with the Work Improvements in Small Enterprises (WISE) concept. While the provision of information and other types of expert input is a *necessary* precondition to initiate the change process, it is not a *sufficient* precondition. To accomplish the first step, which is to obtain *access* to the decision-maker, it may be essential to demonstrate that improved environmental performance is economically attractive, 'pollution prevention pays' and it may be crucial to emphasise that improved OHS conditions go hand in hand with productivity improvements.

Yet, this conceptual framework is intrinsically deficient in explaining actual company behaviour and in predicting the outcomes of the intervention. At the extreme, even the most compelling financial arguments in favour of improved environmental or OHS performance may vanish if other and stronger claims for managerial attention arise.

In short, it is not a question of whether a new practice pays, it is how do owner-managers want to spend scarce resources (primarily their attention).

The bounded rationality perspective is, in my opinion, consistent with the standard economic notion of opportunity costs. According to this concept, the costs of a certain course of action is determined, not from the course of action itself, but from the opportunities foregone because an alternative course of action cannot be taken. Consider, if scarce managerial attention is absorbed by environmental or OHS issues and therefore cannot be directed towards an urgent customer request. The opportunity cost of that course of action is the possible loss of business income resulting from the neglect of the customer request. It may well be that improved environmental or OHS performance contributes positively to company earnings. Nonetheless, if the alternative action, attending the customer request, would result in a higher contribution to earnings (the opportunity cost), the company has suffered a financial net loss.

The implication -- cost efficiency is an important, though inadequate, driver

It is therefore concluded that favourable financial cost-benefit arguments, which play major roles in both the WMC and the WISE concepts, are too narrowly conceived. Theories of bounded rationality identify managerial attention as the key scarce resource. And the standard economic notion of opportunity costs explains why certain courses of actions may be unattractive even if they have favourable cost-benefit ratios.

A focus solely on favourable financial cost-benefit arguments ignores both managerial attention and opportunity costs, and is therefore, although important, inadequate to predict and explain company behaviour.

The success of the WMC in promoting waste minimisation may more adequately be explained as a combination of regulatory intervention (new effluent standards), a freak landslide closing the sole hazardous waste landfill site, *and* the Club related activities. In the same vein may the failure to initiate OHS changes be explained as a combination of *lack of* regulatory intervention, *an absence* of feelings of urgency, *competing demands* from the threat of environmental closure, and, of course, the less than ideal practical circumstances that this particular intervention was carried out in.

Conclusion

The research activities reported in this chapter have taken place in a complex empirical field comprising a group of companies that are suddenly burdened with new and difficult environmental demands and consequently decide to organise in a Club. Some of the demands arise from public authorities announcing stricter environmental legislation and enforcement. Others result from freak external events, notably a landslide closing an important means of solid waste disposal. Each company faces a unique situation and enters the Club for different reasons. Their unique situation, their reasons to enter, and other major parameters are difficult for an outsider to reveal, cannot be exhaustively described, even less be controlled as a research setting.

The sections in this chapter have reported, discussed, and concluded on issues ranging from a series of specific developments in one company to topics of a more general nature. They have ranged from the *reporting* of a sudden upsurge of innovative cleaner production practices in one company, to a *discussion* of how owner-managers more generally may perceive and react to new demands, and to *speculations* about limitations and shortcomings of two general intervention methodologies. The research setting has been complex, the interactions fluid and sometimes ill-defined, and many of the impressions subjective.

In summarising and concluding on the major points of this kaleidoscopic subject, it is therefore useful to make a first distinction between reflections that are backed by empirical evidence and inferences that arise out of considerations at the theoretical level. This distinction is maintained in the sections below.

Lack of integration leads to sub-optimisation

The opening chapter of this thesis identified empirical evidence in support of the sad hypothesis that environmental interventions may be undertaken with little attention paid to workplace health and safety. That chapter argued that a narrow focus on environmental concerns can overlook problems created or missed with regard to occupational health and safety. Two types of sub-optimalities were identified that could result if integration was not pursued consciously: 1) *media shifting*, which occurs if the 'resolution' of an environmental problem gives rise to new, and unforeseen, problems for worker's health and safety; 2) *missed opportunity*, which occurs if an opportunity exists for improving both environmental and OHS performance, but a less optimal solution is chosen that only addresses environmental performance.

- The empirical evidence support the hypothesis that environmental interventions may be undertaken narrowly, with little or no attention paid to workplace health and safety. Many of the companies had not identified their present OHS performance systematically and were consequently *unaware* of many of their OHS problems. Awareness is a major precondition for companies to be able to *consider* possible adverse OHS issues that may arise from new environmental practices. Empirical evidence support that other major business decisions, for instance regarding layout of production equipment, had been taken with little or no regard to how this may impact on OHS, indicative that this would also be case for environmental decisions. None of the small companies indicated that they had given consideration to OHS issues when they introduced new environmental practices. Available empirical evidence therefore support that environmental projects may be executed narrowly, largely ignoring OHS effects.

- It is noteworthy, however, that I found no empirical evidence of media shifting. Many of the cleaner production practices that have been promoted in the Club have addressed problems of the 'twin-problem' variety in which problems in the external and the internal environment have the same underlying cause: the use of a toxic or obnoxious substance in the production process. Even that the decision to renounce cadmium electroplating or the decision to move away from cyanide process technology is taken strictly on environmental grounds, it is also beneficial to workers. If the use of trichloroethylene becomes less appealing strictly on OHS grounds, possibly leading to discontinuation of its use, this development is also beneficial to the environment. But I did not

observe any instances where OHS had deteriorated because a waste minimisation practice had been implemented[116].

- There were however examples of missed opportunities. A hoist installed to improve drip-off (an environmental issue) may also alleviate lifting strain (an OHS issue). However, with a little extra effort the hoist arrangement could likely be expanded to alleviate lifting strain also in the subsequent rinse steps, which was not done (missed opportunity). If a cadmium plating line is completely overhauled in order to introduce cascade and counter-flow rinses, and OHS issues are largely ignored in this process, then missed opportunities are extremely likely.

Major assumptions of the WMC concept confirmed empirically

There is consistent empirical evidence in support of the major assumptions of the Waste Minimisation Club concept.

- Interviews with owner-managers unanimously confirm that cost-savings is a major motivating factor for them to consider preventive strategies to waste minimisation.

- The intervention strategy of linking cost-savings with improved environmental performance is successful. The Club companies have reported significant monetary savings together with significant reductions in the amount of wastes generated. The environmental performance is largely achieved by preventing pollution at the source and through more efficient usage of raw materials.

- The club concept has been a successful organisational vehicle. The Club was instrumental in giving the metal finishing industry voice and influence in negotiations with authorities. Other actors utilised the club structure to gain access to the industry: authorities, providers of environmental expert knowledge, chemical suppliers, waste disposal companies. It is my clear impression that the social interaction amongst Club member also was an important motivating factor

[116] It is true that new OHS hazards may arise when workers handle toxic sludge from the new effluent treatment plants. It can furthermore be speculated if the large holding and settling tanks that some companies erected to hold large quantities of effluent water for treatment and neutralisation purposes have introduced new hazards to the surrounding community. In particular regarding the risk of accidental release of larger quantities cyanide gasses in a scenario where pickling acid is first dumped to the holding tank, followed by a large spill of cyanide. Effluent treatment is, however, not a cleaner production practice, it was not a Club priority, and therefore not a topic of direct interest here.

- Information sharing amongst Club members did take place in the Club. Information and experiences regarding waste minimisation and effluent treatment practices were pooled at Club meetings and discussed amongst members. There was no empirical evidence of altruistic behaviour -- only some members contributed and only certain types of information were disclosed. Yet, the alternative view, that fierce commercial competition and selfish business behaviour are simply incompatible with (naïve) information sharing arrangements cannot be supported empirically. Information sharing is a viable strategy.

- There is consistent empirical evidence that the provision of financial subsidies for cleaner production is highly attractive to small companies. In interviews, owner-managers mentioned lack of own capital, difficult access to foreign capital, and high interest rates, as major obstacles hindering the introduction of cleaner production practices through process modification. Gaining access to financial subsidies from Danced was a major reason for initiating the Metal Finishing Association.

This conclusion comes as a surprise to me. I would intuitively have thought that small companies would expect to find the bureaucratic procedures and formal requirements of a large development assistance organisation (Danced) too cumbersome, and too demanding on managerial attention to be worth the effort.

- Last, that there have been significant intangible benefits from the Waste Minimisation Club arrangement. A channel of communication has been established with the authorities, the usual adversarial relations have given way to dialogue and compromise. A sense of trust has emerged, at least amongst key platers and regulators. The Club established a forum where chemical suppliers and waste disposal firms (i.e. industry service providers) could address the industry and discuss issues of broader interest, for instance the feasibility of future waste handling schemes.

Major assumptions of the WISE concept confirmed empirically

Interviews and observations provides empirical evidence in support of several major assumptions of the WISE concepts.

- Empirical evidence support that improved productivity is an issue of major interest to owner-managers. Productivity issues are effective when contacting business owners and make them spend time listening to what you have to say. Figuratively speaking, productivity may open the door and pave the way for OHS acitivities.

- There were several obvious examples where productivity improvements would in fact go hand in hand with improved OHS

conditions. There were examples of inefficient work station design or inefficient usage of machinery in which productivity improvements were possible. Those improvements would also alleviate a number of OHS problems. Empirical evidence therefore support that it is a viable strategy to use productivity improvements to leverage OHS improvements. This confirms the important assumption of the WISE concept of linking working conditions with other management goals.

- The WISE concept emphasises the need to build on local practice. In practice, this presumes that some companies already have simple and effective practical solutions in place to problems that are general to a larger group of companies. The idea is that the training session material should be based, as far as possible, on local good practice, reinforcing and spreading positive achievements. Empirical evidence support the viability of this approach. It was relatively easy to identify praiseworthy local practices, and companies generally permitted them being photographed and shown to a wider audience.

- Finally, empirical evidence support that there is no alternative to driving the process from the top, by the owner-manager or his direct representative. Two attempts to involve worker representatives failed.

Integration at the level of methodology is viable and beneficial

The first general conclusion of this chapter concerns the *viability* of integrating an environmental intervention and a workplace intervention. The Waste Minimisation Club (WMC) concept and the Work Improvement in Small Enterprises (WISE) concept are methodologically very similar:

- They employ the same type of driving strategy, which is to link up with broader management goals. The WMC concept links waste minimisation with monetary savings. The WISE concept links better working conditions with productivity improvements. Both concepts thus rely on improved cost-efficiency as a major driver to influence the decision-making behaviour of companies.

- Both concepts identify the firms' owner-manager at the focal point for the intervention.

- Both concepts rely on the same organisational structure (a Club or group), in which the activities take place.

- Both concepts rely on the provision of expert knowledge in combination with more informal activities and social interaction in which sharing of information and experiences takes place.

- The concepts employ roughly the same methodology and use actions plans as instruments for change. The WMC concept use environmental reviews and surveys, mostly undertaken by third party experts, which form the basis for a written list of recommendations (the action plan). The WISE relies on group activity, in which owner-managers 'audit' the facilities of each other. The notes taken during this audit constitutes the action plan.

Compared to the WMC concept, the WISE concept is more elaborated in at least two regards. First, it has more *structural content*. The action manual is structured and extensive, logically divided into ten sections with many pedagogic easy-to-comprehend illustrations and suggestions. This comprises a rich catalogue of ideas that can aid the search for local good practice when training material for the specific intervention is produced. The trainer's manual is in a similar manner thoroughly prepared with example course programmes, checklist exercises, and suggestions on how to carry out the presentations, highlighting potential pitfalls, etc.

Second, it has more *political content* in its recognition of roles and potential conflicts of interest. The difficult and challenging life of an owner-manager of a small enterprise is given quite extensive coverage, in particular emphasising that the business activities often absorb the owner, that the owner becomes the business, and that critique of the business may be perceived as a personal critique of the owner. Precisely this recognition of roles, and the identification of mistrust towards authorities and 'experts' more generally, are extremely important as they guide the training approach with its emphasis on peer activities and action learning. These differences may simply reflect that the WISE concept is older and that more concerted efforts have gone into its development compared to the more recently developed WMC concept.

The second general conclusion of this chapter therefore concerns the range of potential synergies that an integrated approach may benefit from

- That the concepts contribute with complementary strengths. The WMC concept can contribute with the charm of novelty and the general goodwill associated with environmental interventions. The WISE concept can contribute with a tested intervention strategy based on principles of action learning.

- Earlier discussion (on page 234) led to the conclusion that many CP practices came at a cost in terms of a deterioration in productivity resulting from less flexibility and increased complexity in the production process. An interesting synergy could therefore arise if this productivity deterioration was counteracted by productivity improvements achieved through WISE activities.

- Finally, that synergies may arise because an integrated approach focus the attention on root causes that give rise to both environmental problems and adverse working conditions (twin problems).

The core conclusion of this chapter is that key preconditions are met for a successful integration of the WMC and the WISE concepts. The two concepts are methodologically very similar. They may furthermore strengthen each other. The chances for a successful integration at the level of methodology are therefore high.

This general conclusion is based on analysis and inferences at the *level of theory*. The empirical evidence presented in this chapter support that all major preconditions for an integrated approach are met but the research did not produce empirical evidence that integration actually took place. This is attributed to the practical circumstances that were less than ideal. It is highly plausible that the WISE intervention never reached critical mass. Moreover, there is no empirical evidence in support of the opposite hypothesis: suggesting that integration should not be feasible.

Too simplistic assumptions about drivers

Finally, this chapter argues that favourable financial cost-benefit arguments, which play major roles in both the WMC and the WISE concepts, are too narrowly conceived. Theories of bounded rationality identify managerial attention as the key scarce resource. And the standard economic notion of opportunity costs explains why certain courses of actions may be unattractive even if they have favourable cost-benefit ratios. This analysis, at the level of theory, leads to the following conclusions:

- A focus solely on favourable financial cost-benefit arguments ignores both managerial attention and opportunity costs, and is therefore, although important, inadequate to predict and explain company behaviour. The intervention becomes far more effective if supported on a broader front, notably if backed by regulatory action (or a credible threat of regulatory action) in the form of stricter requirements or tightened enforcement of existing legislation or financial instrument in the form of water levies or waste charges.

- A more benign way of improving intervention effectiveness, not wielding a stick, could be to set up better incentives, sweetening the carrot so to say. Subsidies were highly attractive to the small enterprises and could be an effective encouragement. In particular, attractive subsidies could be made conditional that both OHS and environmental issues are considered.

Raising intervention effectiveness through the stick approach, involving more regulation or higher financial charges, are probably

unrealistic, however. Many of South Africa's contemporary problems regarding poverty and crime are perceived as inseparable from high unemployment rates. Job creation is a major priority to the Government and small and medium sized enterprises are seen as the most realistic, perhaps the only, providers of those new jobs. Regulatory action or financial charges that would conflict with the objective of encouraging growth of the small business sector are therefore unlikely to be implemented[117].

This leaves the carrot (subsidies) as the most realistic option to improve implementation efficiency.

[117] For an overview of the Government's priorities, see for instance President Mbeki's State of the Nation Address (Mbeki 2000) or 'Labour laws killing small business, says Mbeki' (MG 20000216). The broader role of small and medium sized enterprises in industrial development is an extremely interesting subject that unfortunately falls outside the scope of this thesis. A good review is given by Nanjundan (1987)

Chapter 9. Conclusion

The initial chapter introduced a hypothesis, which has informed most of this work -- that environmental interventions may be pursued narrow-mindedly with little or no attention paid to occupational health and safety. The chapter then identified two potential negative outcomes from this narrow-minded approach, essentially leading to sub-optimal solutions. The first was the potential for *media-shifting* -- that the 'resolution' of a problem within the environmental domain creates a problem in the occupational health and safety domain, leading to a deterioration of workplace conditions. The second was the potential for *opportunities foregone* -- that an environmental intervention fails to address occupational health and safety problems that are in principle unrelated but which could have been resolved at little or no additional cost.

This study finds ample empirical evidence supporting the hypothesis that environmental objectives are pursued quite narrow-mindedly. In the case of Danced's cleaner production projects, they do not specifically address occupational health and safety issues. Workplace conditions are therefore largely ignored.

This study argues that this state of affairs is regrettable -- in itself an opportunity foregone. An analysis of the developments of environmental paradigms identifies cleaner production as the most obvious candidate for integration of environmental and occupational health and safety interventions. Cleaner production is the *only* environmental paradigm that is concerned with detailed analysis of the production process, being the only environmental paradigm that shares this focus with occupational health and safety.

Chapter 3 introduced a model for analysing possibilities for integration. The model identified three main areas: tools, actors, and structure integration. Each level represents different understandings of organisational behaviour which in turn implies different strategies for accomplishing integration. The two case studies reported in Chapter 6 lead to the following two general conclusions:

- First, that OHS issues must feature in the Project Document (PD), that is, integration at the *structures* level. If the PD is silent on occupational health and safety issues, this can only be interpreted by the implementing consultant as evidence that

OHS is not a legitimate project objective. In turn, this entails that OHS must appear more prominently in in the Terms of Reference (TOR) that start the process of planning a new project.

- Second, that it is important to integrate OHS into the methodologies that the implementing consultant uses, when he pursues a CP intervention. This is integration at the *tools* level.

This type of integration was then the subject of detailed empirical examinations in the following Chapter 7 and Chapter 8 -- one regarding interventions in large companies, the other regarding interventions in small companies. Both empirical studies are independent of Danced CP projects. And both concluded that integration at the level of methodology was a viable approach.

Returning to the purpose of this thesis, it has been argued that integration at the *structures* level and the *tools* (methodology) level should be undertaken. What about the *actors* level? This type of integration would call for the introduction of an actor that can safeguard OHS interest while the project is being implemented and who can seize unexpected opportunities for integration as they arise.

The keyword here is unexpected. This thesis has consistently argued that planning tools in use in development planning have a number of inherent deficiencies. In both case studies of CP projects, the LFA planning tool twisted project objectives and favoured rigour over relevance. The planning tool forced the problem description and the stakeholder dialogue to appear more logically consistent and less ambiguous than they really were. This influence was not benign, merely helping to structure and streamline a project. Rather, there is a real risk that the LFA planning tool will distort a project due to its obsession with quantifiable indicators. Planning entails perils.

In the fish project, the plan was re-interpreted during the implementation phase. In the metal finisher project, a major, yet completely unforeseen, accomplishment took place[118] even before the (delayed) project was started. It appears that not too much reliance can be laid on the effectiveness of integrating OHS into plans.

[118] The formation of an association of small industries, as described on page 238. In the perspective of project planning and control, it is ironic that this major, yet completely unforeseen, development took place before the (delayed) Danced project was even started.

This Ph.D. project cannot escape the reality of unpredictability either. Despite the best of planning efforts, the plan of this project was not executed according to the plan. In fact, the plan was soon obsolete due to unforeseen external events. The textile CP project, which, according to the plan, was the major research object, i.e. the major source of empirical data, was delayed for over a year and did not materialise until after I had left South Africa. Alternative avenues had to be explored or the Ph.D. project would sink. The two intervention studies for large and for small companies were excellent opportunities, yet completely unforeseen in the plan.

Allocation of attention has been a key theme pervading this thesis. Attention is a scarce resource -- there are simply more things to do than there is time to do them; there are more claims on attention that can be met. Information has to be discovered through search and attention -- the allocation of attention therefore affects the amount of information that is available, and thus the decision (and organisational behaviour).

A key conclusion of this thesis would naturally be to devise types of integration that focus attention on OHS issues. One such effective means would be to introduce an OHS actor, partly during planning but especially during project implementation. The idea is that this actor would identify and seize on unforeseen opportunities for integrating OHS issues with CP, as they emerge. While effective, it is, however, unlikely to be efficient -- the cost of such actor being quite high.

OHS professionals in Denmark and elsewhere may ask what happened to the employees -- why are they not considered in the actor discussion? This project has considered integration of OHS into *environmental* intervention projects. None of the environmental interventions have included even the slightest employee participation component -- they are all top-down managed. Additionally, it has been argued that South Africa's past has created an industrial relations system in which consensus seeking and compromising have only recently emerged. The study has not seriously sought to challenge this framework imposed by environmental interventions. While employee participation is a major occupational health and safety strategy in Denmark and elsewhere, this study has not sought to impose that strategy onto environmental projects in South Africa.

Danced's CP projects comprise a budget-line to subsidise investments in plant hardware that will improve the environmental performance of the firm. The companies that partake in CP projects are expected to undertake feasibility studies after which they can forward investment proposals to Danced and apply for a co-financing subsidy. Events have clearly demonstrated that this subsidy is highly attractive to both the large and the small companies. In the fish project, the implementing consultant had to defuse a potential conflict over how to administrate the subsidy early in the project. In the Club study, small

companies decided to form an industry association to increase their chances of winning subsidies from Danced.

A strategy informed by theories of attention, which is both effective and efficient, would therefore simply be to favour applications for subsidies to investments that alleviate twin problems. In this manner, the companies are informed that investment proposals that improve both OHS and environmental performance will have preference over investment proposals that do not.

In summary, the key conclusions on how to integrate OHS in CP projects are:

1. It is a necessary precondition that OHS be established as a *legitimate project objective*. This issue must feature in the TOR and in the Project Document. The legitimacy of OHS issues must be reflected at all levels in the LFA matrix, from objectives to outputs.

2. OHS issues should be integrated at the level of methodology in the implementation phase. The methodology used by the consultant to promote CP in industry should be modified also to accommodate OHS issues. The research undertaken in this study provides consistent empirical evidence in support of the viability of this approach -- both for large companies for which a formal management system approach may be attractive, and for small companies for which an informal network intervention approach may be more attractive.

3. Positive incentive structures should be established that reward companies that address twin problems. Twin problems are characterised as those in which problems in the external and the internal environment have the same root cause. The most efficient manner of doing this is to target the physical investment subsidy element, simply giving preference to investment proposals that improve both OHS and environmental performance.

4. It is likely to be effective to enlarge the actor system and introduce an actor that can safeguard OHS interest while the project is being planned and implemented and who can grab unexpected opportunities for integration as they arise. This approach should be considered in the planning phase. However, in the protracted implementation phase, the costs of such an actor are likely to be prohibitive. While effective, this approach is unlikely to be an efficient means of integration in the implementation phase.

The last comment will be devoted to emphasising the quite ambitious nature of the goal of integration. This thesis has argued persistently that an integrated approach should be pursued, both from a rational point of view concerning efficiency and sub-optimal solutions, but also on ethical grounds. It is morally repulsive if endeavours to improve

environmental performance disregard the environment of the workers -- potentially deteriorating workplace conditions, and probably overlooking opportunities to improve them at little or no additional cost.

Yet, in practice, there are tremendous structural and administrative problems to overcome. This thesis has examined methods to promote an integrated approach in a Danish development assistance agency's projects targeting *South African* industry. The author is well aware that attempts to integrate environmental and OHS issues in the *Danish* public administration have failed and that earlier attempts in Denmark to stimulate an integrated approach at company level have been short-lived. Denmark has not its own house in order in this respect[119].

While this study has identified several shortcomings in Danced's planning of environmental assistance projects, most notably tendencies to favour rigour over relevance, it is to Danced's credit that the organisation has been open to an enquiry of this type. It is to Danced's credit that it has produced written statements in support of an integration attempt, that it has given the author access to planning and implementation activities, and generally has been open-minded to OHS issues.

[119] For instance, a recent report by the Danish EPA on reuse of domestic waste promises in its title that both environmental and occupational health and safety issues are considered. Yet, there is not a single reference to OHS in the entire report. (Miljøstyrelsen 1999, MP493)

Chapter 10. References

Aarås, A. (1994) *The impact of ergonomic intervention on individual health and corporate prosperity in a telecommunications environment* Ergonomics 37(10):1679-1696

Act 102 (1996) *National small business Act, no. 102 of 1996* Government Gazette

Act No. 12 (1998) *Marine Living Resources Act, No.18* Government Printer

Aldrich, M. (1997) *Safety First. Technology, labor, and business in the building of American work safety* Johns Hopkins University Press ISBN 0-8018-5405-9

Aldrich, P.T.; Lorentzen, B.; Nielsen, L.; Remmen, A. (1995) *Medarbejderinddragelse i forebyggende miljøarbejde - en håndbog* Miljønyt nr. 16, Miljøstyrelsen ISBN 87-7810-400-9

Alteren, B. (1999) *Implementation and evaluation of the Safety Element Method at four mining sites* Safety Science 31(3):231-264

Skou Andersen, M.; Hansen, M. W. (1991) *Vandmiljøplanen. Fra forhandling til symbol* Niche ISBN 87-983290-2-2

Andersen, E.; and Jespersen, C. (1995) *More food, less waste in seafood processing* United Nations Environment Programme (UNEP) Industry and environment 18(1):19-22

Andersen, M.S; Jørgensen, U. (1995) *Evaluering af indsatsen for renere teknologi 1987-1992. Resultater, spredning og fremtidige aktiviteter* Miljøstyrelsen (Eng: Danish Environmental Protection Agency) Nr. 5 ISBN 87-7810-356-8

Anon. (1982) *Planned task observations* Loss Control Survey 1(1):20-23 A chamber of mines publication, South Africa

Anon. (1982) *Front page picture of training of black mine workers* Loss Control Survey 1(2):1 (November issue) A chamber of mines publication, South Africa

Argyris, C.; and Schön, D.A. (1991) *Participatory action research and action science compared* in: Whyte (ed.) Participatory action research (pp 85-95) Sage ISBN 0-8039-3742-3

Ashford, N.A. (1997) *Industrial safety: the neglected issue in industrial ecology* Journal of Cleaner Production 5(1-2):115-121

Barchiesi, F. (1997) *Flexibility and changes in forms of workplace subjectivity. A case study of the South African automobile assembly industry* University of the Witwatersrand (MA sociology thesis), Johannesburg, South Africa

Barclay, S.; and Buckley, C. (2000) *Waste minimisation clubs - Pilot studies in KwaZulu Natal* SA Waterbulletin 26(3)

Baskin, J. (1998) *The 1998 bargaining round in South Africa. An analysis of the strike wave and bargaining settlements* Report commissioned by the ILO/Swiss Project for the Department of Labour

Baskin, J.; Grawitsky, R. (1998) *Year of fire - industrial action in 1998* SA Labour Bulletin 22(6):6-13

BCEA (1997) *Basic conditions of employment Act no. 75 of 1997* Government Printer Statutes of the Republic of South Africa - Labour, Issue 33, pp 301-389

Bech-Hansen, J. (2001) *LFA course for Danida personnell* Rambøll

Bell, T. (1999) *Inside labour: Cosatu's uneasy partnership with ANC faces new tests* Business Report February 12, 1999, p 2

Bell, T. (1999) *Inside labour: Fight against water privatisation has finally dried up* Business Report May 07, 1999, p 2

Bell, T. (1999) *Inside labour: Time to swap sophistry for tough talk* Business Report May 21, 1999, p 2

Bell, T. (1999) *Inside labour: There is an alternative to Gear, and the unions wrote it* Business Report May 28, 1999, p 2

Bell, T. (1999) *Inside labour: It's pay-back time, say unions after landslide victory* Business Report July 09, 1999, p 2

Bell, T. (1999) *Conflict beckons over casual labour and pensions* Business Report Dec 17, 1999, p 10

Bell, T. (2000) *Inside labour: Tripartite tensions may come to a head at July meeting* Business Report Jan 14, 2000, p 2

Bell, T. (2000) *Inside labour: South Africa`s giant step to international norms* Business Report Feb 25, 2000

Bell, T. (2000) *Inside labour: Demonstrations merely reflect subterranean rumblings* Business Report May 19, 2000:2

Bierma, T.J.; Waterstraat, F.L. (1999) *Cleaner production from chemical suppliers: understanding shared savings contracts* Journal of Cleaner Production 7:145-158

Blank, V. L.G.; Andersson, R.; Lindén, A.; Nilsson, B.-C. (1995) *Hidden accident rates and patterns in the Swedish mining industry due to involvement of contractor workers* Safety Science 21(1):23-35

Blewett, V. (1994) *Beyond lost time injuries: Positive Performance Indicators for OHS. Summary paper* In: Positive Performance Indicators for OHS Part 1, National Occupational Health and Safety Commission. Worksafe Australia ISBN 0 644 35266 3

Bourque, L.B.; Clark, V.A. (1992) *Processing data. The survey example* Sage Series: Quantitative applications in the social sciences, no. 07-085 ISBN 0-8039-4741-0

BR 19990611 (1999) *Monoweld leads the field in galvanising* Business Report June 11 (advertisement inset)

BR 20000310 (2000) *Letters to the editor: Contracting expands employment* Business Report March 10, 2000:2

BR 20000329 (2000) *Violence feared in VWSA feud* Business Report March 29, 2000:1

BR 20000410 (2000) *Brain drain `biggest threat` to growth* Business Report April 10, 2000

BR 20000411 (2000) *Textile unions call for inquiry after Chinese win state contract* Business Report April 11, 2000

BR 20000411 (2000) *Cosatu campaign strikes Gauteng* Business Report April 11, 2000

BR 20000413 (2000) *Cosatu gives May Day deadline to business* Business Report April 13, 2000:3

BR 20000416 (2000) *Strike gets thumbs down from textile bosses* Business Report April 16, 2000

Broberg, O. (1997) *Integrating ergonomics into the product development process* International Journal of Industrial Ergonomics 19(4):317-327

BT 19980628 (2000) *Saldanha is ready to roll after rehearsals* Business Times 28 Jun 98

Catchpowle, L.; Stanworth, J.; Winters, J. (1998) *Paradise postponed: dilemmas facing shop stewards in the new South Africa - accomodation or resistance?* Industrial Relations Journal 29(4):270-279

CCPS: Center for Chemical Process Safety (1993) *Guidelines for Implementing Process Safety Management Systems* American Institute of Chemical Engineers (AIChE), New York ISBN 0-8169-0590-8

Hale, A.R.; Chaplin, R. (1998) *An evaluation of the use of the International Safety Rating System (ISRS) as intervention to improve the organisation of safety* Pergamon Press In Hale and Baram (eds): Safety Management : The Challenge of Change. Chapter 10 ISBN 0-0804-3075-9

Christensen, P.; Nielsen, E.H.; Remmen, A. (1997) *Miljøstyring og miljørevision i danske virksomheder. Midtvejsevaluering.* Miljøstyrelsen / Erhvervsfremmestyrelsen Okt 97 ISBN 87-90147-61-8

Clifton, R. (2000) *The consequences of new enterprise structures* Magazine of the European Agency for safety and health at work 2:14

COID Act (1993) *Compensation for occupational injuries and diseases Act no. 130 of 1993, as ammended by Act no. 61 of 1997* Government Printer Statutes of the Republic of South Africa - Labour, Issue 33, pp 33-131

Danced (1997) *Danced support to cleaner production in Southern African* Pamphlet, Danced country office, June 1997

Danced (1998) *Final project document. Cleaner production in the South African fish industry* PEMconsult, June 1998

Danced (1999) *Draft final project document. Cleaner production in the metal finishing industry, South Africa.* PEMconsult, Oct 1999 (Ref M/123/138-0117)

Danida (1990) *Handbook on logical framework approach. LFA for project preparation. Volume 1: procedures and examples*

Ministry of Foreign Affairs, Danida (1994) *Environmental assessment for sustainable development* The Danish Ministry of Foreign Affairs, Copenhagen ISBN 87-7265-196-2

Danida and Danced (1997) *Strategi for dansk regional miljøbistand til Sydøstasien* Danida and Danced, Nov 1997 ISBN 87-601-2723-6

Danida and Danced (1999) *Environmental assistance to developing countries. The environment and disaster relief facility (EDRF). Annual report, 1998.* Danida and Danced, May 1999 ISBN 87-7909-535-6

De Klerk, Elred (1998) *Getting there. Managing affirmative action constructively* Track Two 7(2):18-36. Publication of the Centre for Conflict Resolution and the Media Peace Centre. Rondebosch, South Africa

DEAT (2000) *White paper on integrated pollution and waste management for South Africa* Government Gazette 20978:1-88 (March 17, 2000)

DOL (1997) *Ensuring effective service delivery: restructuring of labour centres, inspection and employment services* Department of Labour, Pretoria

DOL (1999) *Fifteen point programme of action of the ministry of labour 1999-2004* Government Printer RP:175/99 ISBN 0-621-29456-X

Durban Metro (1999) *Guidelines for the management of metal finishing industry effluent developed by the Durban Chamber of Commerce bylaws working group. Final draft.* In: Second workshop: Waste minimisation and industrial symbiosis - Workshop report. Workshop held November 29, 1999, Falkenberg, Cape Town, by University of Cape Town, South Africa pp. 15-20

Economist (1999) *South Africa - Hail a taxi and die* The Economist May 16th 1999, pp. 49-52

Eisner, H.S. Leger, J.-P. (1988) *The international safety rating system in South African mining* Journal of Occupational Accidents 10:141-160

Eisner, H.S. Leger, J.-P. (1988) *Safety in South African mines: An analysis of accident statistics* Journal of the South African Institute of Mining and Metallurgy 88(1):1-7

EPA (1996) *International waste minimisation approaches & policies to metal plating* EPA - Environmental Protection Agency, USA EPA530-R-96-008

EU (1989) *Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work* European Union, Official Journal L183, 29/06/1989 p.0001-0008

Francis, S.; Dugmore, H.; and Schacherl, R. (1999) *International maid of mystery. A new Madam & Eve collection* David Phillip Publishers, Cape Town and Johannesburg ISBN 0-86486-443-4

French, W.L.; Hollmann, R.W. (1975) *Management by objectives: the team approach* California Management Review 17(3):13-22 Reprinted in French et al.(eds.) Organisational development. Theory, practice and research. pp 336-347

Gallagher, C.; Underhill, E.; and; Rimmer, M. (2000) *Review of the effectiveness of OHS management systems in securing healthy and safe workplaces* Report prepared for the National Occupational Health and Safety Commission, Australia, Sept 2000

Gardner, D.; Cross, J.A.; Fonteyn, P.N.; Carlopio, J.; and Shikdar, A. (1999) *Mechanical equipment injuries in small manufacturing businesses* Safety Science 33(1-2):1-12

Goldschmidt, L.B. (1995) *Ydremiljø - Arbejdsmiljø. Er samtænkning nødvendigt?* NES (Nordic ergonomic society) Menneske, arbejde og miljø - et bæredygtig samspil? Proceedings fra Nordisk Ergonomiselskabs årskonference okt. 1995. pp. 21-33

Gombault, M.; and Versteege, S. (1999) *Cleaner production in SMEs through a partnership with (local) authorities: successes from the Netherlands* Journal of Cleaner Production 7:249-261

Gray, W.B.; and Scholz, J.T. (1993) *Does regulatory enforcement work? A panel analysis of OSHA enforcement* Law and Society Review 27(1):177-213

Greewood, D.J.; and Levin, M. (1998) *Introduction to action research. Social researchers for social change.* Sage

Grunberg, L.; Moore, S.; and Greenberg, E. (1996) *The relationship of employee ownership and participation to workplace safety* Economic and Industrial Democracy 17:221-241

Gunningham, N. (1998) *Towards innovative occupational health and safety regulation* The Journal of Industrial Relations 40(2):204-231

Handberg, S. (1993) *Arbejdsmiljø og renere teknologi i fiskeindustrien* Arbejdsmiljøfondet ISBN 87-7359-648-5

Harvey, S. (1996) *Labour market killing fields* SA Labour Bulletin 20(2):28-31

Hasle, P.; Nielsen, F. (1994) *Desk study on integration of working environment in Danida programmes and projects* Center for Alternativ Samfundsanalyse (CASA), Copenhagen, Denmark

Heald, G. and Rakusin, G. (1996) *Deep-rooted conflict and the industrial relations interface in South Africa* South African Journal of Labour Relations 20(2):23-50

Hedlund, F.H. (1999) *Questionnaire results. South African fish industry - Cleaner production study tour to Denmark* May 1999. Working paper forwarded to Danced's Pretoria office

Hedlund, F.H. (2000) *South African manufacturing industry - analysis of fatal accident statistics (and trends) 1970-1999* Working paper. Dated July 1, 2000 (revision 05)

Hedlund, F.H. (2001) *Five-Star safety rating score predicts injury rates* Working paper. Dated Nov 25, 2001 (revision 16)

Holdt, K.v. (1990) *Theme: The Mercedes Benz dispute* SA Labour Bulletin 15(4):14-44

Holdt, K.v.. (1995) *From politics of resistance to politics of reconstruction? The union and "ungovernability" in the workplace?* Paper presented to the second international conference on emerging union structures. The Swedish Institute of Work Life Research.

Holdt, K.v. (2000) *The new union vision. Reconstructing in a democratic South Africa* SA Labour Bulletin 24(2):60-65

Holdt, K.v. (2000) *Implementing the vision. Reconstruction through teamwork* SA Labour Bulletin 24(2):66-71

Hopkins, A. (1994) *The limits of lost time injury frequency rates* In: Positive Performance Indicators for OHS Part 1, National Occupational Health and Safety Commission. Worksafe Australia ISBN 0 644 35266 3

Hopkins, A. (1999) *For whom does safety pay? The case of major accidents* Safety Science 32(2-3):143-153

Hopkinson, M. (2000) *The sweet smell of success* The Safety & Health Practitioner 18(7):26-28

Horwitz, F. (1995) *Flexible work practices in South Africa: economic, labour relations and regulatory considerations* Industrial Relations Journal 26(4):257-266

Hunter, N.J.; and Mangum, S.L. (1995) *Economic regulation, employment relations, and accident rates in the U.S. motor carrier industry* Labor Studies Journal 20(1):48-63

International Committee of the Red Cross (1999) *People on war: Country report South Africa* ICRC, Geneva. November 1999 (http://nt.oneworld.org/cfdocs/icrc/anyfs.cfm?section=0&pagepath=pages/reports/index.html)

ILO (2001) *Development of ILO Guidelines on Occupational Safety and Health Management Systems (OSH-MS)- information note* International Labour Organisation (ILO) http://www.ilo.org/public/english/protection/safework/managmnt/inote.htm (ver Jan 12, 2001) accessed April 6, 2001

ILO (2001) *Draft ILO technical guidelines on occupational safety and health management systems* International Labour Organisation (ILO) ILO OHS-MS 2001 (draft Feb 2001)

James, D.; Grennan, S.; and Mulhern, G. (1994) *Ergonomics in Northern Ireland: A survey of knowledge, attitudes and implementation in industry and the public services* Ergonomics 37(5):953-963

Jensen, E.H.; Lukey, P. and Sørensen, P.S. (1998) *The Danced pilot projects in Southern Africa* Paper presented by Danced at the Southern African regional conference on cleaner production. Johannesburg, May 11-13, 1998

Jones, J.H. (1999) *NIOSH control technology and intervention effort for small businesses* American Journal of Industrial Medicine Supl 1:93-95

Kamp, A. (1997) *Integreret miljø- og arbejdsmiljø på danske virksomheder (PhD thesis)* Technical University of Denmark

Kenny, B.; and Bezuidenhout, A. (1999) *Focus: casualisation and outsourcing. Fighting subcontracting, legal protections and negotiating strategies* SA Labour Bulletin 23(3):39-46

Khoza, H. (1998) *Ongoing engagement. Strengthening the relationship between business and government* Track Two 7(2):14-17. Publication of the Centre for Conflict Resolution and the Media Peace Centre. Rondebosch, South Africa

Klasen, S.; and Woolard, I. (2000) *Unemployment and employment in South Africa, 1995-1997* Unpublished Report to the department of finance, South Africa. Final Draft: 22 February 2000

Klen, T. (1997) *Personal protectors and working behaviour of loggers* Safety Science 25(1-3):89-103

Kogi, K. (1990) *The role of the ILO in promoting occupational health and safety in developing countries* In Michael R. Reich, Toshiteru Okubo (Eds): Protecting Workers' Health in the Third World. National and International Strategies. Auburn House, New York, pp. 235-248 ISBN 0-8656-9026-X

Labournet (2000) *Agreement for the provision of services by an independent contractor to a labour broker* Search engine on http://www.labournet.co.za/ - Search parameter="independent contractor", accessed 16 Feb 2000

Lanoie, P.; and Tavenas, S. (1996) *Costs and benefits of preventing workplace accidents: The case of participatory ergonomics* Safety Science 24:181-196

Larsson, T.J. and Betts, N.J. (1996) *The variation of occupational injury cost in Australia; estimates based on a small empirical study* Safety Science 24 (2): 143-155

Launsø, L.; and, Rieper, O. (1997) *Forskning om og med mennesker. Forskningstyper of forskningsmetoder i samfundsforskningen* Nyt Nordisk Forlag Arnold Busck, København, Danmark ISBN 87-17-06565-8

Leger, J.-P. (1992) *"Talking rocks" - an investigation of the Pit Sense of rockfall accidents amongst underground gold miners (PhD thesis)* University of the Witwatersrand, Johannesburg, South Africa

Lemon, A. (1991) *The apartheid city* In Lemon, A (ed.) Homes Apart : South Africa's Segregated Cities, pp. 1-25 ISBN 0-2533-3321-0

Leon, R.N.; Salamon, M.D.G.; Davies, A.W; and Davies, J.C.A (1995) *Commission of inquiry into safety and health in the mining industry (Leon Commission)* Government Printer vol 1-2 (Johannesburg, South Africa)

Levy (Andrew Levy & Associates) (2000) *Strike report - year ending 31 December 1999* Andrew Levy & Associates - Newsletter http://www.alevy.co.za/lab005.htm (14 Feb 2000)

Lewis, P. (1994) *Going for the stars ….. or crashing to the ground. What should the trade union movement do about NOSA.* The Industrial Democracy Review 3(3):15-25

Lindell, M.K. (1997) *Occupational safety and health inspection scores predict rates of workers' lost-time injuries* Accident Analysis and Prevention 29(5):563-571

LRA (1995) *Labour Relations Act no. 66 of 1995* Government Printer Statutes of the Republic of South Africa - Labour, Issue 34, pp 1401-1599

MacDuffie, J.P.; and Pil, F.K. (1997) *Changes in auto industry employment practices: An international overview* ILR Press, Cornell University Press In: Kochan et al. After lean production - Evolving employment practices in the world auto industry (pp 9-42) ISBN 0-8014-3382-7

Macun, I.A. (1989) *The regulation of health and safety in South Africa's manufacturing industry (M.Soc.Sci. thesis)* University of Cape Town, South Africa

Macun, I.; Rosenthal, T.; and Standing, G. (1997) *Trade unions in crisis? Findings from the worker representative survey* South African Journal of Labour Relations 21(1):23-40

Magane, P.; Miller, S.; Goldblatt, M.; and Bethlehem, L. (1997) *Unions and the environment. Life, health and the pursuit of employment* in Bethlehem and Goldblatt (eds.) The bottom line. Industry and the environment in South Africa. Industrial Strategy Project. UCT Press pp 176-193 ISBN 0-8893-6830-9

Mandela, N. (1998) *Political report of the President, Nelson Mandela, to the ANC 50'th National conference 1997* SA Labour Bulletin 22(1):41-43

Mansdorf, Z. (2000) *Will ILO take the lead on OSH management systems?* Occupational Hazards 62(9):71-75

March, J.G. (1994) *A primer on decision making. How decisions happen* The Free Press ISBN 0-02-920035-0

March, J.G. (1999) *The pursuit of organizational intelligence* Blackwell ISBN 0-631-21102-0

Matcon () *Green & clean technology. For increased profit in the seafood industry* COWI, Lyngby, Denmark (undated)

Matcon (1999) *Clean technology in the fishing industry: Catalogue of ideas* Matcon, Lyngby, Denmark

Mayhew, C.; and Quinlan, M. (1997) *Subcontracting and occupational health and safety in the residential building industry* Industrial Relations Journal 28(3):192-205

Mayhew, C; Quinlan, M.; Ferris, R. (1997) *The effects of subcontracting / outsourcing on occupational health and safety: Survey evidence from four Australian industries* Safety Science 25(1-3):163-178

Mbeki, T. (2000) *President Mbeki State of the Nation Address - 4 February 2000* Government Printer http://www.parliament.gov.za/pubs/speech/2000/sp0402.htm (5 Feb 2000)

MG 19960202 (1996) *The world this week* Mail & Guardian http://web.sn.apc.org/wmail/issues/960202/wm960202-58.html - accessed June 6, 2000

MG 20000216 (2000) *Labour laws killing small business, says Mbeki* Mail & Guardian Feb 16, 2000

MG 20001019 (2000) *State can't stop subcontracting* Mail & Guardian http://www.mg.co.za/mg/za/archive/2000oct/features/19oct-subcontract.html accessed Oct 19, 2000

MG 20001103b (2000) *SA leaves blanket maker cold* Mail & Guardian http://www.mg.co.za/za/business.html (accessed Nov 3, 2000)

MG 20001120 (2000) *Deadly blaze sparks workplace probe* Mail & Guardian ZANOW Nov 20, 2000

MG 20001124 (2000) *Department knew about deathtrap factory* Mail & Guardian ZANOW Nov 24, 2001

MG 20001127 (2000) *The facts behind the figures* Mail & Guardian http://www.mg.co.za/mg/za/archive/2000nov/features/27nov-jobs.html (accessed Nov 28, 2000)

MG 20001128 (2000) *Biscuit factory dodges safety inspection* Mail & Guardian ZANOW Nov 28, 2000

MG 20010117 (2001) *Days lost to strikes hits ten-year low* Mail & Guardian ZANOW Jan 17, 2001

MG 20010202 (2001) *Department to blame for fire* Mail & Guardian Feb 2, 2001

MG 20010605 (2001) *Twelve dead in SA taxi smash* Mail & Guardian ZANOW June 5, 2001

Michie, J. (1997) *Developing the institutional framework: Employment and labour market policies* in Michie, J.; Padayachee, V.(eds) The political economy of South Africa's transition. Policy perspectives in the late 1990s. The Dryden Press

Mikkelsen, B. (1995) *Methods for development work and research* Sage ISBN 0-8039-9230-0

Miller, S. (1993) *Health, safety and environment* in David Hallowes (ed.) Hidden faces. Environment, development, justice: South Africa and the global context. pp 96-100 ISBN 0-620-17450-1

Miller, Ted R.; Galbraith, M (1995) *Estimating the costs of occupational injury in the United States* Accident Analysis and Prevention 27(6):741-747

Mintzberg, H. (1994) *The rise and fall of strategic planning. Reconceiving roles for planning, plans, planners.* The Free Press ISBN 0-02-921605-2

Morris, M. and Hindson, D. (1992) *South Africa: Political violence, reform and reconstruction* Review of African Political Economy 53: 43-59

Moses, L.N.; and Savage, I. (1992) *The effectiveness of motor carrier safety audits* Accident Analysis and Prevention 24(5):479-496

Moses, L.N.; and Savage, I. (1994) *The effect of firm characteristics on truck accidents* Accident Analysis and Prevention 26(2):173-179

Mouton, J. (1993) *Positivism* HSRC - Human Science Research Council, Pretoria, South Africa In Snyman (ed.): Conceptions of social enquiry. (pp. 1-36). Second imprint 1997 ISBN 0-7969-1468-0

Mouton, J.; and Marais H.C. (1990) *Basic concepts in the methodology of the social sciences* HSRC - Human Science Research Council, Pretoria, South Africa Rev. ed. 2nd impr 1991 ISBN 0-7969-0648-3

Miljøstyrelsen (1999) *Miljøprojekt nr. 493. Scenarier for øget genanvendelse af dagrenovation samt vurdering af arbejdsmiljø* Miljøstyrelsen (Eng: Danish Environmental Protection Agency) http://www.mst.dk/199910publikat/87-7909-414-7/default.htm (11 Feb 2000) ISBN 87-7909-414-7

Nanjundan, S. (1987) *Small and medium enterprises: some basic development issues* Industry and development 20:1-50

NAO (1999) *Beretning om MIKA-miljøstøtten til udviklingslande* Rigsrevisionen (eng. National Accounting Office) Report 14-1998, publ. Nov 17, 1999 ISBN 87-7434-117-0

Nedlac (2000) *What is Nedlac?* http://www.nedlac.org.za/background.html (5 Feb 2000)

Nelson, D.C.; and Strueber, J.V. (1991) *The effect of open-back vehicles on casualty rates: The case of Papua New Guinea* Accident Analysis and Prevention 23(2-3):109-117

Neuman, W.L. (1994) *Social research methods. Qualitative and quantitative approaches* Allyn and Bacon (2nd ed.) ISBN 0-205-14548-5

Nichols, T.; Dennis, A.; and Guy, W. (1995) *Size of employment unit and injury rates in British manufacturing: a secondary analysis of WIRS 1990 data* Industrial Relations Journal 26(1):45-56

Nielsen, B.B.; Nielsen, U.; Petersen, A.; Schmidt, K.; Toldsted, J.; Grønning, I.; Syska, J.; Nielsen, C.B (1998) *Prioritering af Miljøindsatsen - Værktøjer til virksomhedens ledelse* Miljøstyrelsen (Eng: Danish Environmental Protection Agency) Miljøprojekt nr. 422 1998 ISBN 87-7909-103-2

NOHSC (1994) *Positive Performance Indicators for OHS Part* National Occupational Health and Safety Commission. Worksafe Australia ISBN 0 644 35266 3

Norad (1990) *The logical framework approach (LFA). Handbook for objectives-oriented planning* Norwegian agency for development cooperation (Norad) ISBN 82-7548-081-7

Numsa News (1996) *Danger at Work* Numsa News No 3, Sep 96 - http://www.numsa.org.za/news/dangers.htm (accessed Jan 25, 2000)

Numsa News (1998) *Poor on health and safety* Numsa News No 5, Oct 98 - http://www.numsa.org.za/news/9810-17.htm (25 Jan 2000)

Numsa (1998) *Labouring under labour brokers* Numsa News No 1, Mar 98 - http://www.numsa.org.za/news/9803-08a.htm (25 Jan 2000)

OHS Act no. 85 (1993) *Occupational health and safety Act, No. 85* Government Gazette 337(14918):1-52

Oldenburg, K.U.; and Geiser, K. (1997) *Pollution prevention and ... or industrial ecology* Journal of Cleaner Production 5(1-2):103-108

Paton, C. (1996) *Mine violence - the Myburgh Commission* SA Labour Bulletin 20(6):46-50

Pauw, J.C. (1993) *Peter Winch: The idea of social science and its relation to philosophy* HSRC - Human Science Research Council, Pretoria, South Africa In Snyman (ed.): Conceptions of social enquiry. (pp. 99-110). Second imprint 1997 ISBN 0-7969-1468-0

Peña, D.G. (1997) *The terror of the machine - Technology, work, gender and ecology on the U.S.-Mexico border* The center for Mexican American Studies, CMAS Boooks ISBN 0-191-76562-2

Phillips, G. (2000) *Focus: Petroleum restructuring. Participation and consensus - shopstewards under pressure* SA Labour Bulletin 24(1):37-41

Quinlan, Michael (1999) *The implications of labour market restructuring in industrialized societies for occupational health and safety* Economic and Industrial Democracy 20:427-460

Quinlan, M.; and Mayhew, C. (1999) *Precarious employment and workers' compensation* The International Journal of law and Psychiatry 22(5-6):491-520

Rasmussen, B.H. (1995) *Integration af miljø- og arbejdsmiljøarbejdet i danske virksomheder* NES (Nordic ergonomic society) Menneske, arbejde og miljø - et bæredygtig samspil? Proceedings fra Nordisk Ergonomiselskabs årskonference okt. 1995. pp. 245-250

Rasmussen, B.H.; and Jensen, P.L. (1994) *Working environment management systems - Trends, Dilemmas, Problems* in G.E. Bradley and H.W. Hendrick (eds.) Human Factors in Organizational Design and Management IV, pp. 43-48, Elsevier

Read, A.D. (1999) *Wastes minimisation in the UK. Higher education and the private sector? Driving the agenda forward in the East Midlands* 1st International Conference on Solid Waste, Rome, 7 - 9 April 1999

Read, A.D. (2000) *Waste Minimisation Project Clubs in the UK - putting the environment on the business agenda?* School of Geography, Kingston University, UK (unpublished)

Read, A.D; , Phillips, P.S.; Morris, J.R.; and; Adams, K.T. (2000) *Wastes minimisation: Local government approaches and the regional dimension* http://www.kingston.ac.uk/esg/research/wemru/Regional-Minimisation-paper.doc

Rebitzer, J.B. (1995) *Job safety and contract workers in the petrochemical industry* Industrial Relations 34(1):40-57

Rees, R. (1998) *Focus: working time. A 40-hour week? - the metal and engineering industry* SA Labour Bulletin 22(4):23-31

Rittel, H.W.J.; Webber, M.M. (1984) *Planning problems are wicked problems* In Cross, N. (ed.) Developments in design methodology. (pp 135-144) John Wiley & Sons ISBN 0-471-10248-2

Robens, Lord (Chairperson) (1972) *Safety and health at work. Report of the committee 1970-1972* Her Majesty's stationary office, London

SA Yearbook 1998 (1998) *South African Yearbook (5th ed.)* Government Printer ISBN 0-7970-6348-2

Sacob (2000) *Labour market flexibility – what does it mean?* South African Chamber of Business (SACOB) http://www.sacob.co.za/Labour/Flexibility.htm (5 Feb 2000)

Sacob (2000) *Developing the small business sector in South Africa - a review of regulatory an other obstacles by the South African chamber of business* South African Chamber of Business (SACOB) Feb 1999 (http://www.sacob.co.za/Smallbus/Smb.pdf) (access 5 Feb 2000)

Sagan, S.D. (1993) *The limits of safety. Organizations, accidents and nuclear weapons* Princeton University Press New Jersey, USA ISBN 0-691-02101-5

Salminen, S.; Saari, J.; Saarela, K.L.; and Räsänen, T. (1992) *Fatal and non-fatal occupational accidents: Identical versus differential causation* Safety Science 15: 109-118

SALS (1995) *South African Labour Statistics* Central Statistical Service (CSS), Pretoria

Schön, D.A. (1983) *The reflective practitioner - How professionals think in action* Basic Books (1999 reprint by Ashgate Publ.) ISBN 1-85742-319-4

Shannon, H.S.; and Manning, D.P. (1979) *A note on reported accident rates* Journal of Occupational Accidents 2:245-253

Shannon, H.S.; Robson, L.S.; and Guastello, S.J. (1999) *Methodological criteria for evaluating occupational safety intervention research* Safety Science 31:161-179

Shaw, A. (1994) *OHS performance indicators for benchmarking. Report on the literature review conducted as stage 1 of the Worksafe Australia project to develop a benchmarking methodology for occupational health and safety* National Occupational Health and Safety Commission, Australia In: Positive performance indicators for OHS, Part 1. (http://www.nohsc.gov.au/OHSInformation/NOHSCPublications/fulltext/docs/h2/ppio/PPIO1-05DD.HTM, accessed 25 Nov 2001) ISBN 0-644-35266-3

Silverman, D. (1973) *Introductory comments* Collier-Macmillan Publishers in: Filmer, Phillipson, Silverman, Walsh: New directions in sociological theory. (pp 77-117)

Standing, G.; Sender, J.; and Weeks, J. (1996) *Restructuring the labour market: The South African challenge. An ILO country report* International Labour Organisation (ILO) ISBN 92-2-109513-4

Star 19991217 (1999) *Taxis blamed for surge in traffic deaths - Unroadworthy vehicles, fatigued drivers, overloading and high speeds blamed for series of fatal holiday accidents* The Star Dec 17, 1999:1

Star 19991227 (1999) *Is it any wonder that law-abiding South Africans pack for Perth?* The Star Dec 17, 1999. Letters, p 7

Star 20000309 (2000) *Top judge gets to experience hijacking first-hand* The Star March 09, 2000:1

Star 20000309 (2000) *Provinces agree only on priorities* The Star March 09, 2000:13

Star 20000321 (2000) *Ambush victim tells of his terror after he hit rock on N12* The Star March 21, 2000:2

Star 20000330 (2000) *Baby born with bullet wound after hijack* The Star March 30, 2000

Star 20000413 (2000) *Gunmen kill seven in taxi ambush* The Star April 13, 2000

Star 20000422 (2000) *Gunmen kill six in shebeen attack* The Star April 22, 2000

Star 20000427 (2000) *Attack on paramedics: Second victim dies* The Star April 27, 2000

Star 20000605 (2000) *Seven die in taxi tyre-burst accident* The Star June 5, 2000

Tait, R.; and; Walker, D. (2000) *Marketing health and safety management expertise to small enterprises* Safety Science 36(2):095-110

Taksa, L. (1992) *Scientific management: Techniques of cultural ideology?* The Journal of Industrial Relations 34(3):365-395

Tarp, F. (1993) *South Africa. Background and possibilities for Danish transitional assistance* Danida ISBN 87-7265-159-8

The Star 20000425 (2000) *Baby hijack victim fights for her life* The Star April 25, 2000

Thurman, J.E.; Louzine, A.E.; and Kogi, K. (1988) *Higher productivity and a better place to work. Practical ideas for owners and managers of small and medium-sized industrial enterprises. - Part 2: Trainers' manual* International Labour Organisation (ILO) ISBN 92-2-106410-7

Thurman, J.E.; Louzine, A.E.; and Kogi, K. (1994) *Higher productivity and a better place to work. Practical ideas for owners and managers of small and medium-sized industrial enterprises. - Part 1: Action manual (2nd ed.)* International Labour Organisation (ILO) First published 1988, 2nd impression (with corrections) 1994 ISBN 92-2-106409-3

UK-DTI (1998) *Waste minimisation clubs: setting them up for success* UK-ETBPP/DTI, Ref GG122 (DTI - Department of Trade and Industry, ETBPP - Environmental Technology Best Practice Programme, UK)

Ulicki, T. (1999) *Focus: mining. Basotho miners speak. Subcontracting on South African gold mines* SA Labour Bulletin 23(4):61-66

UNEP (1989) *Environmental aspects of the metal finishing industry: A technical guide* United Nations Environment Programme (UNEP) Technical report series no. 1 ISBN 92-807-12160

UNEP (1991) *Audit and reduction manual for industrial emissions and wastes* United Nations Environment Programme (UNEP) Technical report series no. 7 (1st ed) United Nations ISBN 92-807-1303-5

UNEP (1994) *Government strategies and policies for cleaner production* United Nations Environment Programme (UNEP) Industry and Environment. Paris

UNEP (1998) *A cleaner production manual for the metal finishing industry* United Nations Environment Programme (UNEP) Technology management centre, University of Queensland, Australia, May 1998

UNEP 2001 (2001) *International declaration on cleaner production* United Nations Environment Programme (UNEP) http://www.uneptie.org/pc/cp/declaration/pdfs/company_w.pdf

UNEP (2001) *Cleaner production - related concepts* United Nations Environment Programme (UNEP) http://www.uneptie.org/pc/cp/understanding_cp/related_concepts.htm

UNEP (2001) *Governmental strategies & policies for cleaner production* United Nations Environment Programme (UNEP) http://www.unepie.org/pc/cp/understanding_cp/cp_policies.htm

Varonen, U. (1995) *Safeguarding of lathes and occupational accidents* Safety Science 21(1):15-22

WA 20011123 (2001) *Det halve kongerige (eng: Half the Kingdom)* Weekendavisen 23-29 November 2001, Section 1:4

Walsh, D. (1973) *Varieties of positivism* Collier-Macmillan Publishers in: Filmer, Phillipson, Silverman, Walsh: New directions in sociological theory. (pp 1-12)

Weale, A. (1992) *The new politics of pollution* Manchester University Press ISBN 0-7190-3066-8

Webster, E. (1997) *Defusing the Molotov cocktail in South African industrial relations: The burden of the past and the challenge of the future* in Kuruvilla, S. (ed.) Colonialism, Nationalism, and the Institutionalization of Industrial Relations in the Third World ISBN 0-7623-0496-0

White, N. (1997) *Dust related diseases in former miners - the ODMWA legacy* Occupational Health Southern Africa 3(4):20-24

Wiehahn, N.E. (chairman) (1980) *Report of the commission of inquiry into labour legislation* Government Printer Part 3: Employment and social security, and Part 4: Protection of the safety and health of workers in South Africa

Wilde, G.J.S. (1989) *Accident countermeasures and behavioural compensation: The position of risk homeostasis theory* Journal of Occupational Accidents 10:267-292

Wilde, G.J.S. (1994) *Target risk* PDE Publications (also http://pavlov.psyc.queensu.ca/target/) ISBN 0-9699124-3-9

Willems, H.G.M. (1994) *Environmental care in the chemical industry* Journal of Cleaner Production 2(3-4):177

Wokutch, R.E. (1992) *Worker protection, Japanese style* ILR Press, Itacha, New York ISBN 0-87546-187-5

Wokutch, R.E. ; and Sandt, C.V. (2000) *Occupational Safety and Health Management in the United States and Japan: The DuPont Model and the Toyota Model* Pergamon Press In: Frick, Jensen, Quinlan, Wilthagen (eds.) Systematic occupational health and safety management. Perspectives on an international development (2000) pp.367-387 ISBN 0-08-043413-4

World Bank (2000) *African development indicators 2000* World Bank Publications

World Bank (2001) *Deininger and Squire data set. A new data set measuring income inequality* World Bank, Development Economics Unit http://www.worldbank.org/research/growth/dddeisqu.htm (accessed Oct 6, 2001)

World Bank (2001) *United States at a glance* The World Bank Group: http://www.worldbank.org/data/ (dated 9/19/2001)

Yin, R. K. (1994) *Case study research: Design and methods* 2nd ed., Applied Social Research Methods Series Vol 5, Sage ISBN 0-8039-5663-0

Zwetsloot, G. (1994) *Joint management of working conditions, environment and quality: in search of synergy and organizational learning* Dutch institute for the working environment, NIA, Amsterdam

Zwi, A.; Fonn, S.; Steinberg, M. (1988) *Occupational health and safety in South Africa: The perspectives of capital, state and unions* Soc. Sci. Med. 27(7): 691-702